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OF THE

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OF THE

MICHIGAN GEOLOGICAL AND BIOLOGICAL SURVEY

WITH A LIST OF PUBLICATIONS OF THE

UNITED STATES GEOLOGICAL SURVEY RELATING TO MICHIGAN

1838-1920

R. A. SMITH, STATE GEOLOGIST

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DOUGLASS HOUGHTON,
State Geologist, 1838–1846.

Reports from 1838-1846 were published with Legislative documents as follows:

NOTE: S. D. means Senate Document; H. D., House Document; J. D., Joint Document. State Geologist is abbreviated S. G., and State Geological Survey, S. G. S.

*1838. Report of a select committee of the Board of Regents of the University on the collection of the S. G.
H. D. Vol. I, p. 1-2; S. D. No. 1, p. 1. H. D. No. 55 is duplicate of No. 1. Statement of the expenditures on account of the S. G. S. for the year 1837.
H. D. No. 8, pp. 115-118; S. D. No. 21. (First annual account of the S. G.), pp. 315-318.
Report of the S. G. (first annual).
H. D. No. 24, pp. 276-317, separately, No. 14, pp. 1-39.
Communication from the S. G.
H. D. No. 46, pp. 457-460.

*1839. Report of the S. G., in relation to the improvement of State Salt Springs.
H. D. No. 2, pp. 39-45; S. D. No. 1, pp. 1-7.
Report of the committee on the S. G.'s report in relation to the improvement of the State Salt Springs.
H. D. No. 4, p. 123.
Report of the S. G. in relation to the iron ore, etc., on the school section in town five south, range seven west, in Branch county.
H. D. No. 21, pp. 342-344.
Second annual report of the State Geologist.
H. D. No. 23, pp. 380-507; S. D. No. 12, pp. 264-391.
Report of the Commitee of the Senate on Manufacturers, to whom was referred the communication of the S. G. relative to salt springs and the salines of the State.
S. D. No. 3, pp. 85-86 (parallel to H. D. No. 4).
Communication from the S. G. relative to the S. G. S.
S. D. No. 25, pp. 463-466.

*1840. Report of S. G. relative to the improvement of the salt springs.
H. D. No. 2, Vol. I, pp. 18-23; S. D. No. 8, Vol. II, pp. 153-158.
Annual report of the State Geologist (third, map of Wayne county).
H. D. No. 27, Vol. II, pp. 206-293; S. D. No. 7, Vol. II, pp. 66-153, separately No. 8, pp. 1-120.
Report of the select committee to whom was referred the several reports of the S. G.
H. D. No. 46, Vol. II, pp. 455-461.
Report of the majority of the Committee on Finance on the communication and accounts of the S. G. for 1839.
Report of the minority of the Committee on Finance on the same subject.
Report of the select committee on S. G.'s report and accounts relative to improvement of Salt Springs, etc.
S. G.'s account for the year 1839, the same being the subject matter of the three preceding reports.
S. D. Nos. 15, 16, 17, 18, pp. 209-224.

*1841. Special message concerning State Salt Springs.
H., S. and J. D. No. 5, pp. 235-254.
Annual report of the S. G. (fourth).
H., S. and J. D. No. 11, pp. 472-607, separately H. D. No. 27, pp. 1-184.
Report of the S. G. relative to county state maps.
H. D. No. 35, pp. 94-98.

*1842. Report of the S. G. relative to the State Salt Springs.
H. D. No. 2, pp. 15-21; S. D. No. 1, pp. 1-9.
Report of the select committee in relation to the report of the S. G.
H. D. No. 19, pp. 77-79.
Annual report of the S. G. (fifth).
J. D. No. 9, pp. 436-441.

*1843. Annual Report of S. G. (sixth).
J. D. No. 8, pp. 398-402.
Report of the S. G. relative to the State Salt Springs.
S. D. No. 9, pp. 402-408.

*Publication out of print.

*1844. Annual report of the S. G. (seventh).
S. D. No. 11 (three pages).
D. Houghton undertook an arrangement with the Linear Survey of the U. S. Land Office by which a certain amount of geological work was done, which was never published by the State, the results of which appear largely in the township plats of the Land Office, and in the report of C. T. Jackson, 1849, U. S. S. Ex. D. No. 1, pp. 371-935, H. Ex. D. No. 5, Vol. 3, Part 3, including sub-reports of W. A. Burt and Bela Hubbard on the geology of the sub-divisions of the Linear Survey, First Session 31st Congress, and of Foster & Whitney, U. S. Geologists, Part I, H. Ex. D. No. 69, pp. 1-224 and 12 Plates, First Session 31st Congress; S. Ex. D. No. 2, Vol. 2, p. 147, Second Session 31st Congress; Part II, S. Ex. D. No. 4, Vol. 3, p. 3, Special Session 32d Congress.
The work of the Geological Survey was interrupted by the death of D. Houghton while actively engaged in explorations.

*1846. Report from Geological Department by S. W. Higgins, principal assistant.
J. D. No. 12, 22 pp.
Report of the joint relative committee to the Geological Survey.
J. D. No. 15, 8 pp.

A. WINCHELL, State Geologist, 1859–63, 1869–71.

*First Biennial Report of the Progress of the Geological Survey, embracing observations on the geology, zoology and botany of the Lower Peninsula by A. Winchell, 1860. 339 pp. 1 geological map. Bound in green cloth.

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See Vol. II and Vol. V, also the reports of the Commissioners of Mineral Statistics and the following entry:

*Report of the State Board of Geological Survey for 1891 and 1892. Also reports of Dr. Carl Rominger for 1881 and 1882; of C. E. Wright for 1885 to 1888, inclusive.

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R. C. ALLEN, State Geologist, 1909–1919.

Note: The Publication of the Annual Report, as Such, Under a Single Cover, Was Discontinued With That for the Year 1908, and all Subsequent Reports are Issued in the Form of Publications.

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(j) Directory of the mineral producers of Michigan.

(k) Miscellaneous statistical tables—pottery, mineral waters, clay, sandstone, lime, limestone, sand and gravel, sand-lime brick, brick and tile, summary of mineral products.

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(m) Appendix A. The regulation of drilling and care of deep borings: 1. Flooding of oil and gas sands by water from improperly cased or abandoned and unplugged wells; 2. Menace of oil and gas wells to coal mining operations and to valuable brines, mineral and potable waters; 3. Necessity for the regulation of the drilling and care of borings; 4. Inadequacy of present laws; 5. Difficulties of framing adequate remedial and preventive measures; 6. Conference of interested parties called by the U. S. Bureau of Mines; 7. The proposed regulations.

(n) Appendix B. Bituminous or oil shales: 1. Oil shale industry in the United States in 1860; 2. History of the oil shale industry in Scotland and other countries; 3. Investigation of the oil shale resources of eastern Canada by the Department of Mines of Canada in 1910; 4. Byproducts of the oil shale industry; 5. Recent investigation of the oil shales of Colorado and Utah by the U. S. Geological Survey; 6. Oil shales of Michigan; 7. Oil shales and oil coals as future resources of oil. $0.60 2 lbs

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(b) The Iron Ore Reserves of Michigan, by R. C. Allen: 1. A brief description of the iron bearing formations—relation to other formations; thickness, deformation and alteration; the formation of the ore bodies; depth to which iron ore occurs; 2. Importance of the iron mining industry in Michigan; 3. Permanency of the industry—mining at deep levels, development of unexplored lands, opening of abandoned mines, utilization of low grade ores, and recent estimates of Michigan iron ore reserves; 4. Royalty and ownership; 5. Value of iron ore in Michigan in 1913; 6. Statistical tables on production and value of iron ore, on iron ore reserves, mining costs and appraised value of mines, prices of ore, freight rates, iron ore shipments by mines, ranges and counties; 7. List of active iron mines with location, ownership, depth of bottom levels and number of men employed.

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Publication 17, Geological Series 14. 1912–1914.

Biennial Report of the Director of Michigan Geological and Biological Survey, by R. C. Allen, 104 pp., 1 map.

(a) Organization of the Geological and Biological Survey: 1. Expenditures; 2. Employees.

(b) Powers and duties of the Board of Geological Survey.

(c) Functions of the Geological Survey: 1. Distribution of reports; 2. Correspondence and conferences; 3. Cooperation with the Board of State Tax Commissioners in the appraisal of mines and mineral lands; 4. Reports of the State Geologist to the Board of State Tax Commissioners; 5. Cooperation with the Michigan Securities Commission; 6. Cooperation with the Public Domain Commission.

(d) Progress of the Geological Survey of Michigan: 1. Geological work in the Gwinn Iron Bearing District; 2. On the east end of the Menominee Iron Range; 3. Resurvey of the Gogebic Iron Range between Wakefield and Lake Gogebic; 4. Laboratory studies of Pre-Cambrian rocks in the district between Lake Gogebic and Iron River; 5. Monograph on the copper ore deposits of Michigan; 6. Report of the geology of Limestone Mountain; 7. Report on the brine and salt deposits

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of Michigan; 8. Report on the occurrence of oil and gas in Michigan; 9. Geologic investigation of the limestone resources of Michigan; 10. Studies of the Dundee, Traverse, and Marshall formations; 11. Study of the physiography of Michigan inland lakes; 12. Geologic and physiographic studies of Mackinac Island; 13. Annual report on mineral resources and statistics of mineral production.

(e) Progress of the topographic survey of Michigan (with progress map); 1. Object of the survey; 2. Expenditures for cooperative topographic survey of Michigan; 3. Plan of cooperation in topographic mapping; 4. Report of topographic surveys July 1, 1912, to July 1, 1914; 5. Table of progress of the topographic survey in the United States.

(f) Progress of the Biological Survey of Michigan: 1. Plan of work; 2. Field work for 1913 and 1914; 3. Publications; 4. Recommendations.

(g) Recommendations to the Legislature relative: 1. To a proposed increase in appropriations for topographic mapping—need for and uses of topographic maps, appropriations for the Topographic Survey; 2. To the investigation of water powers, drainage, etc.; 3. To the need of a soil survey of Michigan—organization of a Soil Survey, recommendations; 4. To the regulation of the drilling and care of deep borings—harmful results of unregulated deep drilling, proposed regulations; 5. To the relation of the Geological and Biological Survey to the conservation of the birds and wild animals of the state; 6. To the proposed work of the Biological Survey—report of the Committee on Policy of the Biological Survey, plan of work, and nature of publications.

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Publication 18, Geological Series 15. 1915.

Part I. Contributions to the Pre-Cambrian Geology of Northern Michigan and Wisconsin, by R. C. Allen and L. P. Barrett, and Part II. The Geology of Limestone Mountain and Sherman Hill, in Houghton County, Michigan, by E. C. Case and W. I. Robinson, 190 pp., 12 pls., 16 Figs. (5 Maps).

Part I. Contributions to the Pre-Cambrian Geology of Northern Michigan and Wisconsin. 152 pp., 11 Figs. (5 Maps).

(a) Introduction and acknowledgments.

(b) A revision of the correlations of the Huronian group of Michigan and the Lake Superior region: 1. Correlation of the Animikie series as Middle Huronian; 2. Correlation of the Huronian group in the Gogebic and Marquette districts; 3. Correlation of the Vulcan (iron bearing) series with the Negaunee (iron bearing) series—Marquette and Crystal Falls districts; 4. Correlation of the Negaunee series with the Vulcan series of the Sturgeon trough, Felch Mountain district, Calumet trough, and Menominee range; 5. Correlation of the Ironwood (Animikie) of the Gogebic range with the Vulcan (Middle Huronian) series of the Crystal Falls-Iron River-Florence-Menominee district on the basis of similar relations to intrusive granite; 6. General remarks on the correlation of the Animikie series with the Middle Huronian.

(c) A revision of the sequence and structure of the Pre-Keweenaw formations of the eastern Gogebic iron range: 1. Introductory statement—summaries of the geology based on earlier work and of the writers' conclusions; 2. Archean system; 3. Algonkian system: Lower Huronian—Sunday quartzite and Bad River limestone; Middle (Animikie) Huronian—introductory statement, relation to other formations, geology of the Palms and Ironwood formations, Middle Huronian extrusives, basic extrusives, Presque Isle granite; Upper Huronian—The Copps formation; Keweenawan series—Relation to adjacent formations, Keweenaw(?) gabbro; 4. Structure of the Gogebic range east of Wakefield—Keweenawan series, Copps formation, and Middle Huronian series.

(d) Geology of the Marenisco range: 1. Introductory statement; 2. Archean system—northern area, southern area, relations to adjacent rocks; 3. Middle Huronian (Animikie) series—graywacke-quartzite, iron formation, slate formation, igneous rocks.

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(f) Geology of the Manitowish Range: 1. Results of diamond drilling; 2. General summary.

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Mineral Resources of Michigan for 1914 and prior years. 359 pp., 18 Pls., 24 Figs. (7 Maps).

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(b) The Copper Industry in 1914, by Walter E. Hopper, 35 pp.: 1. General review: the strike of the copper miners, effects of the strike on production and mining costs, losses, effects of the European war—loss of forein markets, closing of copper mines, disorganization of the domestic copper markets, recovery of the copper market at the close of 1914, disasters in the copper country—fires and boiler explosions; 2. Construction work—restriction by strike of 1914; 3. Mine casualties; 4. Sanitary conditions; 5. The Copper Handbook—removal of publication office from Houghton to New York City; 6. The Douglass Houghton memorial at Eagle River; 7. Details of operations of the mining companies in 1914; 8. Statistical tables, by R. E. Hore and W. E. Hopper.

(c) Iron Ore—Statistical tables, by R. C. Allen and O. R. Hamilton, 22 pp.

1. Iron ore shipments by mines and ranges, 1905–1914; 2. Shipments by counties; 3. List of active mines with location, ownership, etc.; 4. Iron ore reserves of Michigan; 5. Value of iron ore shipments; 6. Average cost of delivering ore to sale points, 1909-1913, and 1910-1914; 7. Appraised value of Michigan iron mines.

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(a) Organization of the Geological and Biological Survey.

(b) Progress of the Geological Survey.

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(f) Progress of the Biological Survey: 1. Plan of work; 2. Field work in 1914—investigation of the reptile amphibian fauna of the Manistee region, biological survey of Whitefish Point; 3. Field work in 1915—investigations of Michigan algae, on Michigan fish, on Phanerogamic plants; 4. Preparation and publication of reports and papers; 5. Plan of work for 1916.

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(b) Report of Engineer: 1. Preliminary reconnaissance; 2. Disappearance of original boundary marks; 3. Plan and execution of work; 4. Definition of boundary lines of Ohio and Michigan by laws of Congress; 5. Original surveys; 6. Resurveys; 7. Description of field operations; 8. Monuments; 9. Instruments; 10. Topography; 11. Astronomical observations.

(c) Appendix: 1. Character of monuments—granite posts; 2. Geographic positions; 3. Detailed descriptions of the location of the various posts.

(d) Basis of the Michigan-Ohio boundary dispute, by A. M. Schlesinger, 5 pp., 2 maps: 1. Early maps of the Western County; 2. Inaccuracies of the maps; 3. Misconceptions; 4. The dispute; 5. The compromise; 6. Bibliography of the Ohio-Michigan Boundary dispute.

(e) Appendix I. Lists of libraries and scientific and educational institutions to which reports of the Michigan Geological and Biological Survey are sent.

(f) Appendix II. Catalog and table of contents of the publications of the Michigan Geological and Biological Survey ..... $0.70 1 lb.

**Publication 23, Geological Series 19. 1917.

Geological map of Michigan in colors, 34x42 inches, scale 1:750,000 ..... .50

Publication 24, Geological Series 20. 1917.

The Mineral Resources of Michigan for 1916 and prior years.

Part I. METALLIC MINERALS.

(a) Michigan Copper Industry in 1916, by W. E. Hopper, 50 pp., 7 Figs. (15 maps): 1. General Review—production and value of copper and silver, prices, dividends, wages, metallurgical development, etc.; 2. Construction; 3. Exploration and development; 4. Exploration, description, mineralization, and faulting; 5. Details of operations of mining companies; 6. List of active copper mining companies in 1916; 7. Summary table of results obtained by copper mining companies; 8. Summary table of financial statements of copper mining companies in 1916; 9. Summary table of results obtained by copper mining companies, 1912-16; 10. Geological maps of the Porcupine Mountains and the area between the White Pine mine and Lake Superior.

(b) Iron Ore Industry—statistical tables, 1 Fig.: 1. Summary tables of shipments of iron ore by districts—Marquette, Gwinn, Gogebic, Menominee, Crystal Falls, and Iron River districts; 2. Table of iron ore shipments by ranges; 3. By counties; 4. Number of men employed in Michigan iron mines; 5. List of active iron mines; 6. Iron ore reserves of Michigan; 7. Appraised value of Michigan iron mines; 8. Value of iron ore shipments in 1916; 9. Table showing costs, profits, losses, and assessments of the iron mines of Michigan, 1906–1916.

Part II. NON-METALLIC MINERALS.

(c) PORTLAND CEMENT INDUSTRY, by R. A. Smith, 40 pp., 2 Figs. (2 maps): 1. Classification of cements; 2. History and development of cement manufacture; 3. List of cement companies projected and built in Michigan up to 1917; 4. Raw materials; 5. Raw materials used in Michigan; 6. Marl—formation, occurrence, extent and composition of deposits in Michigan; 7. Table of analyses of Michigan marls; 8. Limestone—occurrence, distribution and character of the limestone formations in Michigan, with tables of analyses; 9. Shales and clays—occurrence, distribution and character of shales and clays in Michigan; 10. Use of gypsum in cement manufacture; 11. Fuels used in burning the clinker; 12. Growth of cement industry in the United States and in Michigan; 13. Statistical tables.

Miscellaneous non-metallic minerals.

(d) Salt industry: 1. Production and value in 1916; 2. History of industry in Michigan—growth in Wayne County; 3. Brine and salt deposits—occurrence and distribution; 4. Statistical tables.

**Publication for sale only.

	Price.	Shipping Wt. or Postage.

(e) Gypsum Industry: 1. History and growth in Michigan; 2. Occurrence and distribution of gypsum; 3. Statistical tables.
(f) Coal: 1. History and growth of coal mining industry in Michigan; 2. Mining conditions; 3. Statistical tables.
(g) Limestone: 1. Growth of limestone industry in Michigan; 2. Distribution and character of the limestone deposits; 3. Statistical tables.
(h) Lime: 1. Lack of growth of industry in Michigan—causes; 2. Statistical table.
(i) Brick and tile products: 1. Occurrence, distribution and character of raw materials; 2. Production and value of output in 1916; 3. Statistical tables.
(j) Clay: 1. Character and distribution; 2. Developments; 3. Uses; 4. Statistical table.
(k) Pottery: 1. Growth of industry; 2. Products; 3. Sources of raw materials; 4. Statistical table.
(l) Sand-lime brick: 1. History and growth of industry in United States and Michigan; 2. Production and value in 1916; 3. Statistical table.
(m) Sandstone: 1. Decline of industry—causes; 2. Statistical table.
(n) Grindstones and scythestones: 1. Occurrence of grind or grit stones in Michigan; 2. Methods of quarrying and manufacturing.
(o) Sand and gravel: 1. Occurrence and distribution of sand and gravel deposits; 2. Developments; 3. Statistical table.
(p) Glass sand: 1. Occurrence and distribution of glass sand in Michigan; 2. Developments; 3. Statistical table.
(q) Natural gas: 1. Sources; 2. Developments; 3. Statistical table.
(r) Petroleum: 1. Occurrences; 2. Developments.
(s) Mineral and spring waters: 1. Decline of industry—causes; 2. Statistical table.
(t) Marble: 1. Occurrence and character; 2. Verde antique marble—occurrence, character and recent developments, etc., near Ishpeming.
(u) Shale: 1. Occurrence, distribution and character of shale in Michigan; 2. Developments.
(v) Slate: 1. Occurrence of black slates in Baraga County; 2. Attempted developments; 3. The Arvon slate quarries.
(w) Trap rock: 1. Occurrence and character of deposits in Michigan; 2. Developments; 3. Statistical table.
(x) Graphite: 1. Occurrence of graphitic slate near L'Anse, Baraga County; 2. Development; 3. Uses.
(y) Mineral paints: 1. Iron ores; 2. Manufactured metallic paints.
(z) Quartz: 1. Mining of vein quartz near Ishpeming; 2. Uses.
(aa) Feldspar: 1. Occurrence of feldspar deposits in Michigan; 2. Investigations and tests; 3. Analysis.
(bb) Celestite: 1. Occurrence in Monroe and Wayne counties; 2. Commercial possibilities.
(cc) Map showing location of mineral industries of Michigan.
(dd) Summary table of production and value of minerals and mineral products in Michigan, 1912-1916.

Part III. Deep borings in Michigan, 49 pp., 1 Fig.

(ee) Descriptions and records by counties: Allegan County—Saugatuck well; 2. Arenac County—Pine River well; 3. Clinton County—A. J. Moss and Verne Walker test borings for coal; 4. Delta County—Chicago and Northwestern Railway Co. at Escanaba and Pine Ridge test hole; 5. Eaton County—Eaton Rapids municipal well; 6. Gratiot County—Ithaca municipal well; 7. Houghton County—Calumet and Hecla Copper Mining Co., well at Lake Linden; 8. Huron County—Bad Axe Sugar Co. well; 9. Ingham County—Lansing municipal well; 10. Ionia County—Ionia municipal well; 11. Jackson County—Jackson well; 12. Kent County—Rockford municipal well; 13. Lenawee County—Continental Sugar Co. well at Blissfield..... $0.80 2 lbs.

Publication 25, Geological Series 21. 1917.

Surface Geology and Agricultural Conditions of Michigan, by Frank Leverett, with a chapter on climate, by C. F. Schneider, 223 pp., 15 Pls., 25 Figs. (4 maps). (This report contains Publication 7, The Surface Geology of the Northern Peninsula and Publication 9, The Surface Geology of the Southern Peninsula revised to date.)

(a) Climatic conditions, by C. F. Schneider, with notes on the Northern Peninsula, by Frank Leverett: 1. Modifying effects of the Great Lakes; 2. Temperature; 3. Frosts; 4. Data on Northern Peninsula frosts; 5. Precipitation; 6. Drought; 7. Sunshine; 8. Winds; 9. Relative Humidity; 10. General climatic data.
(b) The Surface Geology of the Northern Peninsula: 1. Physiography; 2. Glacial features; 3. Lake history; 4. Notes on agricultural conditions—soil classes by counties and townships, and farm and crop data; 5. Water supply; 6. Small scale soil map of the Northern Peninsula.
(c) The Surface Geology of the Southern Peninsula: 1. Glacial features; 2. History of the glacial lakes; 3. Agricultural conditions—soil classes by counties and sections, and farm and crop data; 4. Small scale soil map of the Southern Peninsula..... .60 2 lbs.

Shipping Wt. or Price. Postage.

**Publication 26, Biological Series 5, 1918.

Agaricaceae of Michigan, by C. H. Kauffman, with a chapter on Mushroom Poisoning by O. E. Fischer. In two volumes.

Vol. I, Text, 924 pp., 1 Pl., 4 Figs. Vol. II, Pls. I-CLXXII. This is a comprehensive and finely illustrated report on the Agaric Flora of Michigan. Eight hundred and eighty-four species are described, of which 177 are proven edible MUSHROOMS and 70 are poisonous or suspected..... $4.00 6 lbs.

Publication 27, Geological Series 22.

Mineral Resources of Michigan for 1917 and prior years.

Part I. METALLIC MINERALS.

(a) Michigan Copper Industry in 1917. W. E. Hopper, 74 pages: 1. General Review—production and value of copper, prices, wages, dividends, income and excess profits taxes, structural and metallurgical development, etc.; 2. Exploration and development; 3. Construction; 4. Mining and milling; 5. Details of operations of mining companies; 6. List of active copper mining companies 1917; 7. Summary of results obtained by Michigan copper companies 1917; 8. Summary of financial statements of copper companies; 9. Summary results obtained by copper mining companies 1913–1917.

(b) Iron Ore Industry—statistical tables, 1 figure, pages 77-131: 1. Iron ore shipments from the Marquette range, Gwinn District, Gogebic Range, Menominee District, Crystal Falls District, Iron River District; 2. Summary of iron ore shipments from Michigan Ranges (Gross Tons); 3. Shipments of iron ore for Michigan Ranges by counties; 5. List of active iron mines in Michigan; 6. Iron ore reserves; 7. Appraised value of Michigan iron mines; 8. Value of iron ore shipments 1917; 9. Tables showing costs, profits, losses and assessments of iron mines of Michigan 1906-1917; 10. Analysis of Lake Superior Iron Ores and percentage of Bessemer and non-Bessemer grades, by W. L. Tinker; 11. Graphic record of shipments from iron mines.

Part II. NON-METALLIC MINERALS.

(c) Coal: 1. History and growth of coal mining industry in Michigan; 2. Statistical tables.

(d) Pyrites: 1. War demand for pyrites; 2. Investigation of Michigan coal brasses for pyrites; 3. Analyses and tests.

(e) Salt Industry: 1. Production and value in 1917; 2. History of salt industry in Michigan—revived by War; 3. Brine and salt deposits, occurrence and distribution; 4. Statistical tables.

(f) Bromine and calcium chloride: 1. Development of bromine and calcium chloride production in Michigan; 2. War needs and Government demand for.

(g) Potash: Production and value of, 1917.

(h) Clay: 1. Character and distribution; 2. Development; 3. Uses; 4. Statistical tables.

(i) Brick and Tile Products: 1. Occurrence, distribution and character of raw matuerials; 2. Production and value of output in 1917; 3. Statistical tables.

(j) Pottery: 1. Growth of Industry; 2. Products; 3. Statistical tables.

(k) Sandstone: 1. Decline of industry; 2. Statistical tables.

(l) Grindstones and scythestones: 1. Occurrence of grind or grit stones in Michigan.

(m) Sand and Gravel: 1. Occurrence, distribution and development of sand and gravel deposits in Michigan; 2. Statistical tables.

(n) Glass sand: 1. Occurrence and distribution of glass sand in Michigan; 2. Developments; 3. Analysis.

(o) Sand-lime brick: 1. History and growth of industry in Michigan; 2. Production and value; 3. Statistical tables.

(p) Limestone: 1. Growth of limestone industry in Michigan; 2. Distribution and character of limestone deposits; 3. Statistical tables.

(q) Lime: 1. Lack of growth in industry previous to the War,—causes; 2. War effect on industry; 3. Statistical tables.

(r) Cement: 1. Growth of industry; 2. History; 3. Statistical tables.

(s) Shale: Occurrence, distribution, character and development of shale in Michigan.

(t) Gypsum: 1. History and growth of industry in Michigan; 2.

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Occurrence and distribution; 3. Statistical tables.
(u) Mineral Waters: 1. Decline of industry; 2. Statistical tables.
(v) Natural gas: 1. Sources; 2. Developments; 3. Statistical tables.
(w) Petroleum: 1. Occurrence; 2. Developments.
(x) Marble: 1. Occurrence and character; 2. Verde antique marble—occurrence, development, comparison with Grecian marble.
(y) Graphite: 1. Occurrence of graphite slate in Baraga County; 2. Use.
(z) Mineral Paints: 1. Iron ores; 2. Manufacture from graphitic slates.
(aa) Celestite: Occurrence of, in Monroe and Wayne Counties.
(bb) Feldspar: Occurrence, investigation of feldspar deposits; 2. Analysis.
(cc) Quartz: Mining of quartz near Ishpeming.
(dd) Trap Rock: 1. Occurrence and character of deposits; 2. Uses; 3. Statistical tables.
(ee) Slate: 1. Slate deposits in Northern Peninsula; 2. Attempted developments.
(ff) Map showing location of mineral industries in Michigan.
(gg) Summary tables of production and value of mineral products in Michigan 1913–1917.
Appendix. Directory producers of non-metallic minerals in Michigan in 1917 ..... $0.80 2 lbs.

Publication 28, Geological Series 23, 1918.

Drainage in Michigan, by Dalton G. Miller and Perry T. Simons. 126 pp., 5 Figs., 13 Pls. (2 maps).

(a) Condition affecting Drainage: 1. Rainfall and climate; 2. Topography; 3. Soils.
(b) Wet Lands of Michigan: 1. Reclaimable wet lands of the Southern Peninsula; 2. Swamp and wet lands of the Northern Peninsula; 3. Summary of wet lands of Michigan.
(c) Drainage in Michigan: 1. Earlier drainage; 2. Development of County Drain System, expenditures on, and cost analysis of County Drains; 3. Suggestions on designs of drains, run-off from watersheds, size znd shape of open ditches, grade for open ditches, width of berm; 4. Construction methods; outlets, uniform method of staking ditches, cubic yard basis for letting contracts; 5. Tile drains for county work; 6. Inspection; 7. Maintenance.
(d) The Michigan Drain Law: 1. Purpose of the law; 2. Procedure of establishing a drain; 3. Drains which affect more than one county; 4. Deficiencies in present procedure; 5. Necessity for bonding provision.
(e) Necessity for creation of State Department to handle water resources and drainage matters.
(f) Abstracts of Drainage Laws of Georgia, Iowa, Missouri, Ohio and Wisconsin: 1. Georgia; 2. Iowa; 3. Missouri; 4. Ohio; 5. Wisconsin.. .60 2 lbs.

Publication 29, Geological Series 24,

Mineral Resources of Michigan for 1918 and prior years.

Part I. Metallic Minerals.
(a) Michigan Copper Industry in 1918. L. P. Barrett, 45 pp. 1. General Review—production, sales, value, costs, dividends; 2. Details of operations of mining companies; 3. Table of average cost , receipts, etc., for 1918; 4. List of active copper mining companies 1918; 5. Summary of financial statements of copper companies; 6. Summary results obtained by copper mining companies, 1914–1918.
(b) Iron Ore Industry. O. R. Hamilton. Statistical tables, 4 Figs., 55 pp.: 1. General Review—shipments, mining costs, royalties, market trend for Bessemer pig iron; 2. Iron ore shipments from the Marquette range, Gwinn district, Gogebic range, Menominee district, Crystal Falls district, Iron River district; 3. Summary of iron ore shipments by ranges (gross tons); 4. Shipments of iron ore from Michigan ranges by counties; 5. Number of men employed in Michigan iron mines; 6. List of active iron mines in Michigan; 7. Iron ore reserves of Michigan; 8. Appraised value of Michigan iron mines; 9. Value Michigan iron ore shipments, 1919; 10. Tables showing costs, profits, losses, and assessments of Michigan iron mines, 1906–1918; 11. Graphic record of cost of delivery of Michigan iron ore at the Lower Lake ports; 12. Graphic record of shipments of Michigan iron ore.
Part II. Non-Metallic Minerals.
Non-metallic Industry in Michigan in 1918. H. M. Martin. 1 Fig., 67 pp.: 1. General Review—value, rank, effect of building operations on brick and tile industry, effect of war upon non-metallic industries.
(c) Salt Industry: Production and value in 1918; 2. History of salt industry in Michigan—effect of war upon; 3. Brine and salt deposits—occurrence and distribution; 4. Statistical tables.
(d) Bromine and Calcium Chloride: 1. Development of bromine in Michigan; 2. War uses and Government demand for; 3. Calcium chloride,

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production value and uses.
(e) Cement: 1. Growth of industry; 2. History; 3. Statistical tables.
(f) Potash: Production and value of 1918. By-product of cement industry.
(g) Gypsum: 1. History and growth of industry in Michigan; 2. Statistical tables.
(h) Brick and tile products: 1. Occurrence, distribution and character of raw materials; 2. Production and value of output in 1918; 3. Effect of war upon industry; 4. Statistical tables.
(i) Shale: Occurrence, distribution, character, and development of shale in Michigan.
(j) Clay: 1. Character, distribution, development uses of clay in Michigan; 2. Statistical tables.
(k) Pottery: 1. Growth of industry, products; 2. Statistical tables.
(l) Coal: History and growth of coal mining in Michigan; 2. Statistical tables.
(m) Pyrites: 1. War demand for; 2. Investigation of Michigan coal brasses for pyrites; 3. Analyses and tests.
(n) Limestone: 1. Growth of limestone industry in Michigan; 2. Distribution and character of limestone deposits; 3. Statistical tables.
(o) Lime: 1. Lack of growth of industry before the war—causes; 2. War stimulation of industry; 3. Statistical tables.
(p) Sand-lime brick: History and growth of the industry in Michigan; 2. Production and value; 3. Statistical tables.
(q) Sand and gravel: 1. Occurrence, distribution and development of sand and gravel deposits in Michigan; 2. Statistical tables.
(r) Sandstone: 1. Decline of industry; 2. Statistical tables.
(s) Grindstones and Scythestones: Occurrence of grind or grit stones in Michigan.
(t) Glass sand: 1. Occurrence and distribution of glass sand in Michigan; 2. Developments; 3. Analyses; 4. Government demand for.
(u) Mineral Waters: 1. Decline of industry; 2. Statistical tables.
(v) Natural Gas: 1. Sources, development; 2. Statistical tables.
(w) Petroleum: Occurrence, developments.
(x) Marble: 1. Occurrence and character; 2. Verde antique marble—occurrence, development, comparison with Grecian marble.
(y) Graphite: Occurrence and use of graphitic slate in Baraga county.
(z) Mineral paints: Production of mineral paints from iron ores of Iron County, and from graphitic slate of Baraga County.
(aa) Celestite: Occurrence of in Wayne and Monroe Counties.
(bb) Feldspar: 1. Occurrence, investigation of deposits; 2. Analysis.
(cc) Quartz: Mining of quartz near Ishpeming.
(dd) Trap rock: 1. Occurrence and character of deposits; 2. Uses; 3. Statistical tables.
(ee) Slate: 1. Slate deposits in Northern Peninsula; 2. Attempted development.
(ff) Map showing location of mineral industries.
(gg) Summary tables of production and value of mineral products in Michigan, 1914–1918.

Appendix. Directory producers of non-metallic minerals in Michigan in 1918..... $0.75 2 lbs.

Publication 30, Geological Series 25.

The Inland Lakes of Michigan, by Irving D. Scott.

In preparation, to be issued about April, 1921.

LIST OF AVAILABLE MAPS

STATE MAPS

	Price.
**Publication 23, Geological Series 19. 1916.	
Geological map of Michigan. In colors, 36 in. x 44 in., scale 1:750,000...	$0.50
Map of the Surface Geology or soils of the Northern Peninsula of Michigan. In colors, 32 in. x 60 in., scale 1:380,000, or 6 miles to the inch. This map is the same as that in Pub. 9	.50
Map of the Surface Geology or soils of Northern Peninsula of Michigan. In colors, 13 in. x 24 in., scale 1:1,000,000, or about 16 miles to the inch. This map is the same as that in Publication 25. Map sent free upon request. Extra copies 10 cents each.	
Map of the Surface Geology or soils of the Southern Peninsula of Michigan. In colors, 18 in. x 24 in., scale 1:1,000,000, or about 16 miles to the inch. This map is the same as that in Publications 9 and 25. Map sent free upon request.	
Sketch map of the Surface Geology or soils of the region about the northern shores of Lakes Huron and Michigan. In colors, 8½ in. x 22 in., scale nearly 10 miles to the inch. This map is the same as that in Russell's report in the Annual Report for 1904. Map sent free upon request.	
*Map of the original vegetation of the Northern Peninsula. In colors, about 21 in. x 25 in., scale about 12 miles to the inch. This map is the same as that in the Report on Peat, Annual Report for 1906.	

BASE MAPS

Black and blue base map of Michigan, 36 x 44 in., scale 1:750,000, heavy paper	.35
Black base map of Michigan, prepared by the U. S. Geological Survey. In two parts, scale 1:500,000, light paper	.45
Part I. Map of the Northern Peninsula, including the northern part of the Southern Peninsula, 34 in. x 52 in	.20
Part II. Map of the Southern Peninsula, excepting the northern portion, 34 in. x 52 in	.25
Black base map of the Northern Peninsula, 13 in. x 24 in., scale 1:1,000,000, heavy paper	.10
Black base map of the Southern Peninsula, 18 in. x 24 in., scale 1:1,000,000, heavy paper	.10

*Out of print.
**For sale only.

COUNTY MAPS

ARENAC COUNTY.

Map showing Palaeozoic formations of Arenac County, topography of surface in contours, culture, etc. In colors, 20 x 34 in., scale 1:62,500, or about one inch to one mile. Map sent free upon request.

BARAGA COUNTY**

	Price.
No. 164. Map of Baraga County, showing topography, geology, culture, and municipal boundaries. *Blue print*, 36 in. x 41 in., scale 1 in.:1 mi.	$0.40
No. 164½. Map of vicinity of Huron Bay, Baraga County, showing geology, rock outcrops, topography, and culture. *Blue print*, 27 in. x 29 in., scale 2 in.:1 mi	.25
No. 14A. Township plats of Baraga County. *Blue print*, 14 in. x 14 in., T. 48 N., R. 31 W., scale 2 in.:1 mi. Vicinity of Michigamme. Geology, swamps, lakes, rivers, and culture	.20
No. 14B. T 48 N., R. 32 W., scale 2 in.:1 mi. Vicinity of Nestoria. Swamps, rivers, lakes, and culture	.20
No. 14C. T. 48 N., R. 33 W., scale 2 in.:1 mi. Geology, swamps, lakes, rivers, rock outcrop, and culture	.20
No. 14D. T. 48 N., R. 34 W., scale 2 in.:1 mi. Geology, swamps, lakes, rivers, rock outcrops, and culture	.20
No. 14E. T. 48 N., R. 35 W. (W. ½ in Houghton Co.), scale 2 in.:1 mi. Vicinity of Sidnaw. Swamps, rivers, lakes, rock outcrops, and culture	.20
No. 14F. T. 49, R. 33 W., scale 2 in.:1 mi. Vicinity of Detroit Graphite Co. and Northern Graphite Co. mines. Topography, geology, rock outcrops, and culture	.20
No. 14G. T. 50 N., R. 30 W., scale 2 in.:1 mi. Topography, geology, rock outcrops, and culture	.20
No. 14H. T. 50 N., R. 31 W., scale 2 in.:1 mi. (also 4 in.:1 mi., $.25). Geology, topography, rock outcrops, and culture	.20
No. 14I. T. 50 N., R. 32 W., scale 2 in.:1 mi. Geology, topography, rock outcrops, and culture	.20
No. 391. T. 50 N., R. 33 W. Scale 2 in.:1 mi	.20
No. 14K. T. 51 and 52 N., R. 30 W. Scale 2 in.:1 mi. Topography, geology, rock outcrops, and culture	.20

BAY COUNTY

Topographic map of Bay County; 14 in. x 20 in., scale about 1 in:2 mi. This map is the same as that in the Bay County Report, Annual Report for 1905. Map sent free upon request.

Topographic map of Bay County, showing surface geology. In colors, same base as above. Map sent free upon request.

Topographic map of Bay County, showing artesian well areas. In colors; same base as above. Map sent free upon request.

DELTA COUNTY**

No. 122. Map of the region west of Escanaba, showing magnetic belts. *Blue print*, 18 in. x 34 in., scale 2 in.:1 mi	.25

DICKINSON COUNTY**

No. 162. Map of Dickinson County, showing topography, geology, and culture. *Blue print*, 30 x 41 in., scale 1 in.:1 mi	.30

GOGEBIC COUNTY**

No. 169–170. Map of Gogebic County, in two parts, showing geology, topography, culture, etc. *Blue print*, scale 1 in.:1 mi	.75
No. 169. I. West End; 38 in. x 40 in	.40
No. 170. II. East End; 32 in. x 40 in	.35
No. 172A. Map of Gogebic Iron Range from West Branch of Montreal River, Wisconsin, east to Lake Gogebic, Michigan, showing geology, topography, culture, etc. *Blue print*, 15 in. x 69 in., scale 2 in.:1 mi	.50
No. 173A. Map of Gogebic Iron Range (T. 47 N., R. 42-44 W., excepting top tier of sections), showing geology, topography, outcrops, etc. *Blue print*, 32 in. x 78 in., scale 4 in.:1 mi	.65
Township plats in Gogebic County. *Blue prints*, 28 in. x 28 in., scale 4 in.:1 mi	each .25
No. 26. T. 43 N., R. 37–38 W. (west half in Iron County), 14 in. x 26 in. scale 2 in.:1 mi. Rivers, lakes, etc.	
No. 34. T. 43 N., R. 38 W. (Fractional). Streams, lakes, etc.	
No. 35. T. 43 N., R. 39 W. (Fractional). Streams, lakes and swamps.	
No. 36. T. 44 N., R. 38 W. Magnetic survey, culture, etc., in south-central part.	

*Out of print.
**For sale only.

No. 37. T. 44 N., R. 39 W. Streams, lakes and swamps.
No. 38. T. 44 N., R. 40 W. (Fractional). Magnetic and geologic survey, culture, etc.
No. 39. T. 44 N., R. 41 W. (Fractional). Magnetic and geologic survey, rock outcrops, topography (sketched), culture, etc.
No. 40. T. 44 N., R. 42 W. (Fractional). Magnetic and geologic survey, culture, etc., of the northwest corner.
No. 41. T. 44 N., R. 43 W. (Fractional). Streams, lakes, etc.
No. 42. T. 45 N., R. 38 W. Magnetic and geologic survey, culture, etc.
No. 43. T. 45 N., R. 39 W. Magnetic and geologic survey, topography (sketched), culture, etc.
No. 44. T. 45 N., R. 40 W. Magnetic and geologic survey, culture, etc.
No. 45. T. 45 N., R. 41 W. Magnetic and geologic survey, rock outcrops, culture, etc.
No. 46. T. 45 N., R. 42 W. Magnetic and geologic survey, culture, etc.
No. 47. T. 45 N., R. 43 W. (Fractional). Magnetic and geologic survey, culture, etc., of the southeastern half of the township.
No. 48. T. 45 N., R. 44 W. (Fractional). Magnetic and geologic survey, culture, etc.
No. 49. T. 45 N., R. 45 W. (Fractional). Magnetic and geologic survey, culture, etc.
No. 50. T. 45 N., R. 46 W. (Fractional). Streams, lakes, etc.
No. 51. T. 46 N., R. 39 W. Magnetic and geologic survey, rock outcrops, topography (sketched). culture, etc.
No. 52. T. 46 N., R. 40 W. Magnetic and geologic survey, rock outcrops, topography (sketched), culture, etc.
No. 53. T. 46 N., R. 41 W. Magnetic and geologic survey, rock outcrops, topography (sketched), culture, etc.
No. 54. T. 46 N., R. 42 W. Magnetic and geologic survey, rock outcrops, culture, etc.
No. 55. T. 46 N., R. 43 W. Magnetic and geologic survey, rock outcrops, culture, etc.
No. 56. T. 46 N., R. 44 W. Magnetic and geologic survey, rock outcrops, culture, etc., of the south half of township.
No. 57. T. 46 N., R. 45 W. Magnetic and geologic survey, rock outcrops, culture, etc., of the southeast corner of the township.
No. 58. T. 46 N., R. 46 W. Streams, lakes, etc.
No. 59. T. 46 N., R. 47 W. Streams, lakes, etc.
No. 60. T. 47 N., R. 39 W. Streams, lakes, etc.
No. 61. T. 47 N., R. 40 W. Streams, lakes, etc.
No. 62. T. 47 N., R. 41 W. Streams, lakes, etc.
No. 63. T. 47 N., R. 42 W. Streams, lakes, etc.
No. 64. T. 47 N., R. 44 W. Streams, lakes, etc.
No. 65. T. 47 N., R. 45 W. Streams, lakes, etc.

HOUGHTON COUNTY**

Price.

Nos. 181–182. Map of Houghton County (in two parts), showing geology, topography, culture, etc. *Blue print*, scale 1 in.:1 mi..... $0.60
No. 181. I. Northern part Ts. 51-56 N., Rs. 31-36 W.; 39 in. x 41 in. .40
No. 182. II. Southern part, Ts. 47-50 N., Rs. 35-37 W.; 20 in. x 30 in. .25
Township plats of Houghton County. *Blue prints.*
No. 65A. T. 47 N., R. 36 W., 14 in. x 14 in., scale 2 in.:1 mi. Rivers, swamps, lakes, roads, culture, etc..... .20
No. 65B. T. 47 N., R. 37 W., 14 in. x 14 in., scale 2 in.:1 mi. Geology, rock outcrops, culture, etc..... .20

HURON COUNTY

Map of bed rock geology and topography of Huron County. In colors, 23 in. x 28 in., scale ½ inch to the mile. This map is the same as that in the Geological Report on Huron County, Part II, Vol. VII. Map sent free on request.

IRON COUNTY**

No. 165. Map of Iron County, showing geology, topography, culture and municipal boundaries. *Blue print*, 38 in. x 44 in., scale 1 in.:1 mi.. .40
No. 168. Map of Iron River District, showing surface and rock contours. *Blue print*, 38 in. x 38 in., scale 4 in.:1 mi..... .40
Township plats of Iron County. *Blue prints.*
No. 15. T. 42 N., R. 34 W. (Fractional), 26 in. x 30 in., scale 4 in.:1 mi. Magnetic survey of northwestern part..... .25
No. 16. T. 42 N., R. 35 W. (Fractional), 26 in. x 30 in., scale 4 in.:1 mi. .25
No. 16½. T. 42 N., R. 35 W. Scale 2 in.:1 mi. Magnetic survey, geology and rock outcrops in an east-west belt through the center of Twp.. .25
No. 17. T. 42 N., R. 36 W. (Fractional), 26 in. x 30 in., scale 4 in.:1 mi. Magnetic survey, culture, etc..... .25
No. 18. T. 42 N., R. 36 W. (Fractional), 11 in. x 13 in., scale 2 in.:1 mi. Magnetic survey, geology, rock outcrops, topography (sketched), culture, etc..... .20

**Maps for sale only.

Price.

No. 19. T. 42 N., 37 W. (Fractional), 15 in. x 26 in., scale 4 in.:1 mi. Magnetic survey, culture, etc. $0.25

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KEWEENAW COUNTY

**No. 183. Map of Keweenaw County, showing geology, topography (sketched), culture, etc. *Blue print*, 26 in. x 43 in., scale 1 in.:1 mi. .35

*Geologic map of the Allouez Gap Area, showing topography in contours and the location of some of the principal beds of the Keweenaw series. This map is the same as that in Vol. VI, Pt. II. 12 in. x 12 in.

Geologic-Topographic map of Keweenaw Point in contours. 22 in. x 34 in., scale 1 in.:1 mi. This map is the same as that in Vol. VI, Pt. II. Map sent free upon request.

MARQUETTE COUNTY**

Nos. 150-2. Map of Marquette County, in three parts. *Blue print*, scale 1 in.:1 mi. .90

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Township plats of Marquette County. *Blue prints.*

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No. 123. Map of the magnetic belts in the vicinty of Radford. *Blue print*, 11 in. x 17 in., scale 2 in.:1 mi. .20

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*Out of print.
**For sale only.

*MONROE COUNTY

Price.

Map of surface geology or soils, and topography of Monroe County. In color. 16 in. x 18 in., scale ½ mile to the inch. This map is the same as that in the Geological Report on Monroe County, Part I, Vol. VII.

Map of bed rock geology and topography of Monroe County. In colors; same base as above. This map is the same as that in the Geological Report on Monroe County, Part I, Vol. VII.

ONTONAGON COUNTY**

Nos. 178-180. Map of Ontonagon County (in three parts), showing geology, topography, and culture. *Blue print*, scale 1 in.:1 mi..... $0.95
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Preliminary geological map of the Porcupine Mountains and vicinity, 13 in. x 16 in., scale 1 in.:2 mi. Map sent free upon request.

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Township plats of Ontonagon County. *Blue prints.*

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WASHTENAW COUNTY

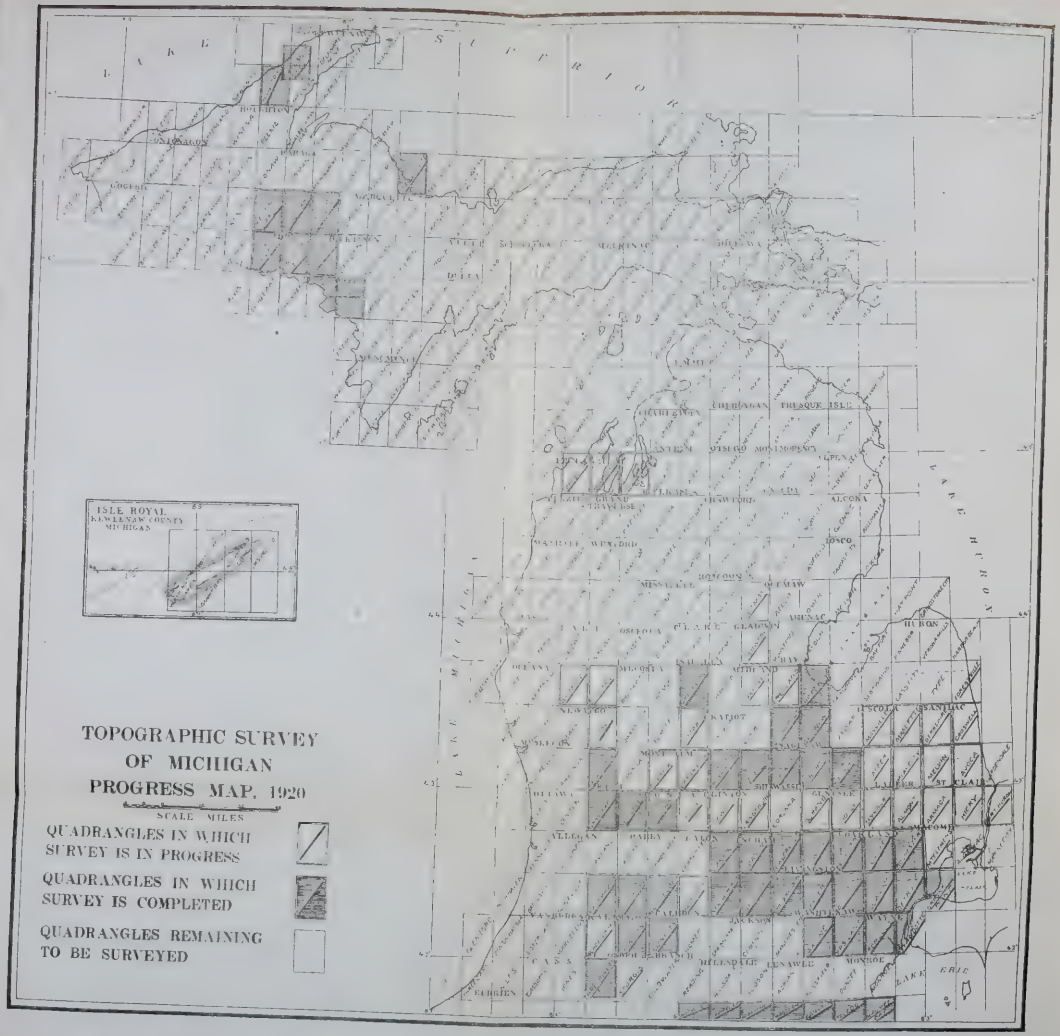
Topographic map of the Ann Arbor Quadrangle, showing contours of elevation, timber areas, culture, etc. Scale 1:62,500, or about 1 in. to one mile, 27 in. x 37 in. Map sent free upon request.

WAYNE COUNTY.

Map of Wayne County, showing surface geology or soils, topography and depth of drift in contours, culture, etc. In colors. 33 in. x 41 in., scale 1:62,500, or about 1 mile to the inch. This map is the same as that in Publication 12. Map sent free upon request.

Map of Wayne County, showing hard rock geology, artesian well conditions, topograhy of the surface and hard rocks in contours, culture, etc. In colors, 33 x 41 inches, scale 1:62,500, or about 1 mile to the inch. This map is the same as that in Publication 12. Map sent free upon request.

*Out of print.
**For sale only.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KEWEENAW COUNTY
MICHIGAN
TOPOGRAPHIC SURVEY
OF MICHIGAN
PROGRESS MAP, 1920
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QUADRANGLES IN WHICH SURVEY IS IN PROGRESS
QUADRANGLES IN WHICH SURVEY IS COMPLETED
QUADRANGLES REMAINING TO BE SURVEYED
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LAKE MICHIGAN
LAKE ERIE
LOWER PENINSULA
HOUGHTON
BARAGA
GOGEBIC
MARQUETTE
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MACKINAC
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JACKSON
WASHTENAW
WAYNE
CASS
ST. JOSEPH
BRANCH
HILLSDALE
LENAWEE
MONROE
BERRIEN

SOIL MAPS

Price.

The Survey has on file unpublished manuscript maps made by Mr. Frank Leverett, of the United States Geological Survey, showing the surface geology and the agricultural conditions of the Northern Peninsula and of the following counties and quadrangles in the Southern Peninsula:

Counties: Alcona, Alpena, Antrim, Arenac, Benzie, Charlevoix, Cheboygan, Clare, Crawford, Emmet, Grand Traverse, Iosco, Isabella, Kalkaska, Lake, Leelanau, Manistee, Mason, Mecosta, Missaukee, Montmorency, Newaygo, Oceana, Ogemaw, Osceola, Oscoda, Otsego, Presque Isle, Roscommon, Wexford. Scale ¾th in.:1 mi.

Quadrangles: Battle Creek, Bay City, Camp Custer, Cedar Springs, Chesaning, Elsie, Fowlerville, Galesburg, Grand Rapids, Howell, Ionia, Kalamazoo, Lansing, Leonidas, Mason, Milford, Mount Pleasant, Perrinton, Pontiac, Rochester, St. Charles, Saginaw, Three Rivers, Union City. Scale 1:62,500.

The Survey is prepared to have copies of these maps made upon application. The maps are colored by hand and are sold for $1.25 for the county maps, and $1.50 for the quadrangles.

The United States Bureau of Soils has issued the following soil maps of Michigan:

Allegan, Berrien*, Cass, Calhoun, Wexford Counties; the Alma area in Gratiot County, Oxford area in Oakland County, Owosso area in Shiawassee County, Pontiac area in Oakland County, Saginaw area in parts of Saginaw, Bay, Tuscola, and Huron Counties; and the Munising area in the Northern Peninsula. Scale 1 in.:1 mi.

TOPOGRAPHIC MAPS

The topographic survey of Michigan is being made in cooperation with the U. S. Geological Survey. Each topographic map covers a quadrangular area of about 200 square miles. The maps are on a scale of 1:62,500, or about one mile to the inch. They show the elevation and configuration of the surface by brown lines (contour lines); the roads, cities, villages, schools, etc., by black symbols; and the rivers, swamps, lakes, and drains by blue color. The following quadrangles have been surveyed and the maps may be obtained either from this Survey or from the U. S. Geological Survey, Washington, D. C.

Northern Peninsula: Calumet Special, Crystal Falls, Houghton, Iron River, Marquette, Menominee Special, Ned Lake, Perch Lake, Passage Island, Sagola, Witbeck ..... price, each, $0.10

Southern Peninsula: Alvordton,** Ann Arbor,† Battle Creek, Bay City, Burt,* Camp Custer,†† Cedar Springs, Chesaning, Detroit, Dexter, Elsie, Flint,* Fowlerville, Fremont,** Galesburg, Grand Rapids, Grosse Pointe, Howell, Ionia, Kalamazoo, Lansing, Leonidas, Lowell, Mason, Maumee Bay,** Milford, Montpelier,** Mt. Pleasant, Perrington, Pontiac, Rives Junction,* Rochester, Romulus, St. Charles, Saginaw, Saline, South Lyon, Springport,* Stockbridge,* Swanton,** Three Rivers, Toledo,** Union City, Wauseon,** Wayne, Wyandotte, Ypsilanti.

Price each ..... .10

NOTE: The Dexter, Saline, South Lyon and Ypsilanti sheets, together with maps of the areal geology of the quadrangles, are also published in U. S. G. S. Folio 155, and the Detroit, Grosse Pointe, Romulus, and Wyandotte quadrangles and maps of their areal geology are published in U. S. G. S. Folio No. 205.

*In press.

**Ohio boundary maps.

†Contours in black, forest areas in green. See Folio 155.

††Map formed by combining the Battle Creek and Galesburg quadrangles. A text, prepared by Frank Leverett, printed on the back of the map, gives an account of the geography of the region in the vicinity of Camp Custer with an explanation of the origin of the surface features.

PUBLICATIONS OF THE UNITED STATES GEOLOGICAL SURVEY

PUBLICATIONS OF THE U. S. GEOLOGICAL SURVEY RELATING TO MICHIGAN *which can be obtained only from the United States Geological Survey, or from the Superintendent of Documents, Washington, D. C.*

Folios

Geologic descriptions of nine Michigan quadrangles have been published in folio form by the U. S. Geological Survey.

	Price.
*No. 62. Menominee Special.	
No. 155. The Ann Arbor Folio, covering South Lyon, Dexter, Saline and Ypsilanti quadrangles	$0.25
No. 210. The Detroit Folio, covering Grosse Point, Detroit, Romulus, and Wyandotte quadrangles	.50

Annual Reports

**Tenth Annual Report. Part I, pp. 341-507. The Penokee iron bearing series of Michigan and Wisconsin, by R. D. Irving and C. R. VanHise.

**Seventh Annual Report. 1885-86, pp. 365-454. On the classification of early Cambrian and pre-Cambrian formations, by R. D. Irving.

**Fifteenth Annual Report. 1893-94, pp. 477-650. Preliminary report on the Marquette iron-bearing district of Michigan, by C. R. Van Hise and W. S. Bayley, with a chapter on the Republic Trough, by H. L. Smyth.

Sixteenth Annual Report. 1895-96, Part I, pp. 571-874. *Principles of North American pre-Cambrian Geology, by C. R. Van Hise, with an appendix on the flow and fracture of rocks as related to structure.

Eighteenth Annual Report. 1896-97, Part I, pp. 595-647. **Recent Earth Movements in the Great Lakes Region, by C. K. Gilbert.

Nineteenth Annual Report. **Part III, pp. 1-151. The Crystal Falls iron-bearing district of Michigan, by J. M. Clements and H. L. Smyth, with a chapter on the Sturgeon River Tongue by W. S. Bayley, and an introduction by C. R. Van Hise.

Twenty-first Annual Report. 1899-1900. **Part III, pp. 305-434. The iron-ore deposits of the Lake Superior region, by C. R. Van Hise.

Twenty-second Annual Report. 1900-01. **Part III, pp. 307-331. The Northern Interior coal field, by A. C. Lane, pp. 629-685; The Portland Cement Industry in Michigan, by I. C. Russell.

**Monographs

5. The Copper-bearing Rocks of Lake Superior, by R. D. Irving. 1883. xvi, 464 pp., 29 pls., and maps	1.85
19. The Penokee iron-bearing series of Michigan and Wisconsin, by R. D. Irving and C. R. Van Hise. 1892, xx, 534 pp., 37 pls	1.70
28. The Marquette iron-bearing district of Michigan, with atlas, by C. R. Van Hise and W. S. Bayley, including a chapter on the Republic Trough, by H. L. Smyth. 1897, xxviii, 608 pp., 35 pls. and an atlas of 39 sheets folio	5.75
36. The Crystal Falls iron-bearing district of Michigan, by J. M. Clements and H. L. Smyth, with a chapter on the Sturgeon River Tongue, by W. S. Bayley, and an introduction by C. R. Van Hise. 1899, xxxvi, 512 pp., 53 pls	2.00
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53. The Pleistocene of Indiana and Michigan, and the history of the Great Lakes, by Frank Leverett and F. B. Taylor. 1915. 529 pp., 32 pls	1.50

Professional Papers

**11. The Clays of the United States East of the Mississippi River, by H. Ries. 1903. pp. 298, Pls. 9.

*Out of print.

**Publication may be purchased from the Superintendent of Documents, Washington, D. C.

Bulletins

*62. The greenstone schist areas of the Menominee and Marquette regions of Michigan, a contribution to the subject of dynamic metamorphism in eruptive rocks, by G. H. Williams, with an introduction by R. D. Irving. 1890. 241 pp., 16 Pls.

*86. Correlation papers: Archean and Algonkian, by C. R. Van Hise. 1892. 549 pp., 12 pls.

201. Results of primary triangulation and primary traverse, fiscal year 1901-2, by H. M. Wilson, J. H. Renshawe, E. M. Douglas and R. U. Goods. 1902. pp. 73-75.

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*223. Gypsum deposits in the United States, by G. I. Adams and others. 1904. pp. 45-47.

245. Results of primary triangulation and primary traverse, fiscal year 1903-4, by S. S. Gannett. 1904. Michigan primary traverse, Macomb and Oakland counties, Detroit quadrangle. p. 60.

310. Results of primary triangulation and primary traverse, fiscal year 1905-6, by S. S. Gannett. 1907. Michigan, primary traverse Howell, Leonard, Milford, Pontiac and Rochester quadrangles, pp. 46-49.

440. Results of triangulation and primary traverse, fiscal years 1906, 1907, 1908. R. B. Marshall, chief geographer. 1910. Michigan primary traverse, Calumet, Chelsea, Fowlerville, Laingsburg, Lansing, Mason and St. Johns quadrangles, pp. 325-328.

461. Results of spirit leveling in Michigan and Wisconsin, 1897 to 1909 incl., R. B. Marshall, chief geographer. 1911. 64 pp., 1 Pl.

496. Results of primary triangulation and primary traverse for the years 1909 and 1910. R. B. Marshall, chief geographer. 1912. Michigan primary traverse, Charlotte, Dewitt, Lansing and Springport quadrangles, pp. 162-164.

522. Portland cement materials and industry in the United States, by E. C. Eckel, with contributions by E. F. Burchard and others. 1913. pp. 208-224.

551. Results of triangulation and primary traverse, 1911, 1912. R. B. Marshall, chief geographer. 1914. Michigan, primary traverse, Allegan, Cedar Springs, Centerville, Gobleville, Grand Rapids, Hillsdale, Homer, Ionia, Jenison, Jones, Kalamazoo, Lowell, Marshall, Muir, Ravenna, Schoolcraft, Smyrna and Spring Arbor quadrangles. Beacon Hill, Houghton, Pelkie quadrangles.

Michigan-Ohio-Indiana: Adrian, Alvordton, Blissfield, Dundee, Edor, Hillsdale, Hudson, Reading, Swanton quadrangles.

Michigan-Wisconsin: Black River, Beechwood, Commonwealth, Crystal Falls, Escanaba, Greenland, Hardwood, Hermansville, Houghton, Iron River, Kenton, Menominee Special, Norway, Paynesville, Rubicon, Sagola, Sidnaw, State Line, Watersmeet and Winona quadrangles.

559. Results of spirit leveling in Michigan, 1911-1913. R. B. Marshall, chief geographer. 1914. 79 pp., 1 Pl.

*585. Useful minerals in the United States, compiled by Samuel Sanford and R. W. Stone. 1914. pp. 97 to 100. (See Bulletin 624.)

624. Useful minerals of the United States, compiled by F. C. Shrader, R. W. Stone, Samuel Sanford (a revision of Bul. 585), 1916. pp. 163-169.

644. Triangulation and primary traverse, 1913-1915. R. B. Marshall, chief geographer. (f) Primary traverse in Indiana and Michigan, 1913-15. pp. 297-345.

669. Salt resources of the United States. W. C. Phalen. 1919. pp. 44-67.

697. Gypsum deposits of the United States. R. W. Stone and others. 1920. pp. 122-128.

Water Supply Papers

* 30. Water Resources of the Lower Peninsula of Michigan, by A. C. Lane. 1899. 97 pp., 7 Pls.

*31. Lower Michigan Mineral Waters, a study into the connection between their chemical composition and mode of occurrence, by A. C. Lane. 1899. 97 pp., 4 Pls.

49. Operations at river stations, 1900. Part III. pp. 229-260.

65. Operations at river stations, 1901, East of Mississippi river. 1902. pp. 315-318.

75. Report of progress of stream measurements for the calendar year 1901, by F. H. Newell. 1903. pp. 111-112.

83. Report of progress of stream measurements for calendar year 1902, by F. H. Newell. pp. 241-297.

97. Report of progress of stream measurements for calendar years 1903, by J. C. Hoyt. 1904. pp. 431-465 and 474-499.

102. Contributions to the hydrology of the Eastern United States. 1903. M. L. Fuller, geologist in charge. 1904. pp. 19 and 489-512.

103. A review of laws prohibiting the pollution of inland waters in the United States, Michigan, p. 31.

114. Underground waters of Eastern United States. M. L. Fuller, geologist in charge. 1905. Lower Michigan compiled from report by A. C. Lane, pp. 242-247.

129. Report of progress for the calendar year 1904. Part VI. Great Lakes and St. Lawrence River drainages, by R. E. Horton, Edward Johnson, Jr., and J. C. Hoyt. 1905. 150 pp., 2 Pls.

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147. Destructive Floods in the U. S. in 1904, E. C. Murphy and others. 1905. 206 pp., 18 Pls. Grand River, Michigan, flood, by R. E. Horton. pp. 40-45.

149. Preliminary list of deep borings in the U. S. (2d edition, with additions), by N. H. Darton. 1905. 175 pp.

156. Water powers of northern Wisconsin, by L. S. Smith. 1906. pp. 42-56. (Menominee River System.)

*160. Underground water papers, 1906; M. L. Fuller, geologist in charge 1906. Flowing wells district in the Eastern Part of the Northern Peninsula of Michigan, by Frank Leverett, pp. 29-53, Pl. 1.

*162. Destructive Floods in the U. S. in 1905, with discussion of flood discharge and frequency, and an index of flood literature, E. C. Murphy and others. Flood on Grand River, Michigan, pp. 20-21.

170. Report on progress of stream measurements for calendar year 1905, Pt. VI. Great Lakes and St. Lawrence drainages, by R. E. Horton, F. W. Hanna and J. C. Hoyt. 1906. 116 pp., 1 Pl.

*182. Flowing wells and municipal water supplies in the southern part of the Southern Peninsula of Michigan, by Frank Leverett and others, 1906. 292 pp., 5 Pls.

*183. Flowing wells and municipal water supplies in the middle and northern portions of the Southern Peninsula of Michigan, by Frank Leverett and others. 1907. 393 pp., 5 Pls.

*206. Surface water supplies of Great Lakes and St. Lawrence River drainages. 1906. H. K. Barrows and A. H. Horton, district hydrographers, 1907. 98 pp., 3 Pls.

236. Quality of surface waters in the United States, Pt. I. Analyses of waters east of the one hundredth meridian, by R. B. Dole. 1909. Lake Michigan, pp. 73, 119.

244. Surface water supply of the United States, 1907-08, Pt. IV, St. Lawrence River Basin, prepared under the direction of M. O. Leighton, by H. K. Barrow', A. H. Horton and R. H. Bolster. 1910. 163 pp., 7 Pls

264. Surface water supply of the U. S., 1909, Pt. IV, St. Lawrence River Basin, prepared under the direction of M. O. Leighton by C. C. Covert, A. H. Horton and R. H. Bolster. 1910. 130 pp., 5 Pls.

284. Surface water supply of the United States, 1910, Part IV, St. Lawrence River Basin, prepared under the direction of M. O. Leighton by C. C. Covert, A. H. Horton and R. H. Bolster. 1912. 125 pp., 2 Pls.

304. Surface water supply of the United States, 1911, Part IV, St. Lawrence River Basin, prepared under the direction of M. O. Leighton by C. C. Covert, A. H. Horton and R. H. Bolster. 1912. 98 pp., 4 Pls.

324. Surface water supplies of the United States, 1912, Part IV, St. Lawrence River Basin, by C. C. Covert, A. H. Horton and W. G. Hoyt. 1914. 149 pp., 3 pls.

*340. Stream-gaging stations and publications relating to water resources, 1885–1913, compiled by B. D. Wood. 1916. (d) Part IV, St. Lawrence River Basin, pp. 43-52—xx.

354. Surface water supply of the United States, 1913, Part IV, St. Lawrence River Basin; N. C. Grover, chief hydraulic engineer; W. G. Hoyt, A. H. Horton and C. C. Covert, district engineers. 1915. 136 pp., 2 Pls.

384. Surface water supply of the United States, 1914, Part IV, St. Lawrence River Basin; prepared under the direction of N. C. Grover, chief hydraulic engineer, by W. G. Hoyt, A. H. Horton, C. C. Covert and C. H. Pierce. 1916. 128—xxix pp., 2 Pls.

404. Surface water supply of the United States, 1915, Part IV, St. Lawrence River basin; N. C. Grover, chief hydraulic engineer; W. G. Hoyt, A. H. Horton, C. C. Covert and C. H. Pierce, district engineers. 1917. 122, xxxi pp., 2 pls.

427. Bibliography and index of the publications of the United States Geological Survey relating to ground-water, by O. E. Meinzer. 1918. 169 pp., 1 pl.

434. Surface water supply of the United States, 1916, Part IV, St. Lawrence River basin; H. C. Grover, chief hydraulic engineer; W. G. Hoyt, A. H. Horton, C. C. Covert and C. H. Pierce, district engineers. 1917. 130, xxxii pp., 2 pls.

Mineral Resources of the United States.

Mineral Resources of the United States for 1882-1917, with special reference to:

1903-*b. Cement: Portland cement in Michigan, 1903, by L. L. Kimball.

1907, Pt. II-*a. Coal: Map showing coal fields of the United States, by M. R. Campbell.

1908, Pt. I-*a. Iron Ores, Pig Iron, Steel: Occurrence of iron ores in the U. S., by E. C. Harder; Iron ore reserves of the U. S., by C. W. Hayes; maps of U. S. showing (1) distribution of iron ore, by E. C. Harder, and (2) location of blast furnaces, by W. T. Thom.

*Publication may be purchased from the Superintendent of Documents, Washington, D. C.

1910, Pt. I-*b. Copper: Geological classification of copper deposits, map of U. S. showing location of copper-producing districts and of reduction plants operated in 1908-10; curve showing production of copper in U. S., 1845-1910, by B. S. Butler.

Pt. II-*a. Cement: Portland cement materials and industry of the U. S.; map showing distribution of cement plants in the United States and principal limestone formations east of the Rocky Mountains and in California, by E. F. Burchard.

Pt. II-*b. Coal: Brief descriptions of the coal fields in each of the producing states, illustrated by 14 maps showing the coal areas, by E. W. Parker.

1911, Pt. I-b. Iron ore reserves of Michigan, with map by C. K. Leith.

1915, Pt. I-e. Iron Ore: Beneficiation of Lake Superior iron ores, by Edmund Newton and H. H. Bradt.

Pt. I-1. Copper, by B. S. Butler: Map of the United States showing location of copper producing districts and reduction plants in 1915.

*Publication may be purchased from the Superintendent of Documents, Washington, D. C.

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OF THE

PUBLICATIONS

OF THE

MICHIGAN GEOLOGICAL AND BIOLOGICAL SURVEY

WITH A LIST OF PUBLICATIONS OF THE

UNITED STATES GEOLOGICAL SURVEY RELATING TO MICHIGAN

1838-1920

R. A. SMITH, STATE GEOLOGIST

NOTE: The greater part of the publications of the Michigan Geological and Biological Survey are distributed gratis to public libraries and exchanges, and also to citizens of Michigan on the payment of forwarding charges. *Publications 23 and 26 are distributed gratis to libraries and exchanges, but otherwise are for sale only.* Please ascertain zone and include sufficient postage to cover parcel post rate. A considerable number of copies of each publication are reserved for sale at the list price. County and township maps should be ordered by number.

DOUGLASS HOUGHTON,
State Geologist, 1838–1846.

Reports from 1838-1846 were published with Legislative documents as follows:

NOTE: S. D. means Senate Document; H. D., House Document; J. D., Joint Document. State Geologist is abbreviated S. G., and State Geological Survey, S. G. S.

*1838. Report of a select committee of the Board of Regents of the University on the collection of the S. G.
H. D. Vol. I, p. 1-2; S. D. No. 1, p. 1. H. D. No. 55 is duplicate of No. 1. Statement of the expenditures on account of the S. G. S. for the year 1837.
H. D. No. 8, pp. 115-118; S. D. No. 21. (First annual account of the S. G.), pp. 315-318.
Report of the S. G. (first annual).
H. D. No. 24, pp. 276-317, separately, No. 14, pp. 1-39.
Communication from the S. G.
H. D. No. 46, pp. 457-460.

*1839. Report of the S. G., in relation to the improvement of State Salt Springs.
H. D. No. 2, pp. 39-45; S. D. No. 1, pp. 1-7.
Report of the committee on the S. G.'s report in relation to the improvement of the State Salt Springs.
H. D. No. 4, p. 123.
Report of the S. G. in relation to the iron ore, etc., on the school section in town five south, range seven west, in Branch county.
H. D. No. 21, pp. 342-344.
Second annual report of the State Geologist.
H. D. No. 23, pp. 380-507; S. D. No. 12, pp. 264-391.
Report of the Commitee of the Senate on Manufacturers, to whom was referred the communication of the S. G. relative to salt springs and the salines of the State.
S. D. No. 3, pp. 85-86 (parallel to H. D. No. 4).
Communication from the S. G. relative to the S. G. S.
S. D. No. 25, pp. 463-466.

*1840. Report of S. G. relative to the improvement of the salt springs.
H. D. No. 2, Vol. I, pp. 18-23; S. D. No. 8, Vol. II, pp. 153-158.
Annual report of the State Geologist (third, map of Wayne county).
H. D. No. 27, Vol. II, pp. 206-293; S. D. No. 7, Vol. II, pp. 66-153, separately No. 8, pp. 1-120.
Report of the select committee to whom was referred the several reports of the S. G.
H. D. No. 46, Vol. II, pp. 455-461.
Report of the majority of the Committee on Finance on the communication and accounts of the S. G. for 1839.
Report of the minority of the Committee on Finance on the same subject.
Report of the select committee on S. G.'s report and accounts relative to improvement of Salt Springs, etc.
S. G.'s account for the year 1839, the same being the subject matter of the three preceding reports.
S. D. Nos. 15, 16, 17, 18, pp. 209-224.

*1841. Special message concerning State Salt Springs.
H., S. and J. D. No. 5, pp. 235-254.
Annual report of the S. G. (fourth).
H., S. and J. D. No. 11, pp. 472-607, separately H. D. No. 27, pp. 1-184.
Report of the S. G. relative to county state maps.
H. D. No. 35, pp. 94-98.

*1842. Report of the S. G. relative to the State Salt Springs.
H. D. No. 2, pp. 15-21; S. D. No. 1, pp. 1-9.
Report of the select committee in relation to the report of the S. G.
H. D. No. 19, pp. 77-79.
Annual report of the S. G. (fifth).
J. D. No. 9, pp. 436-441.

*1843. Annual Report of S. G. (sixth).
J. D. No. 8, pp. 398-402.
Report of the S. G. relative to the State Salt Springs.
S. D. No. 9, pp. 402-408.

*Publication out of print.

*1841. Annual report of the S. G. (seventh).
S. D. No. 11 (three pages).
D. Houghton undertook an arrangement with the Linear Survey of the U. S. Land Office by which a certain amount of geological work was done, which was never published by the State, the results of which appear largely in the township plats of the Land Office, and in the report of C. T. Jackson, 1849, U. S. S. Ex. D. No. 1, pp. 371-935, H. Ex. D. No. 5, Vol. 3, Part 3, including sub-reports of W. A. Burt and Bela Hubbard on the geology of the sub-divisions of the Linear Survey, First Session 31st Congress, and of Foster & Whitney, U. S. Geologists, Part I, H. Ex. D. No. 69, pp. 1-224 and 12 Plates, First Session 31st Congress; S. Ex. D. No. 2, Vol. 2, p. 147, Second Session 31st Congress; Part II, S. Ex. D. No. 4, Vol. 3, p. 3, Special Session 32d Congress.
The work of the Geological Survey was interrupted by the death of D. Houghton while actively engaged in explorations.

*1846. Report from Geological Department by S. W. Higgins, principal assistant.
J. D. No. 12, 22 pp.
Report of the joint relative committee to the Geological Survey.
J. D. No. 15, 8 pp.

A. WINCHELL, State Geologist, 1859–63, 1869–71.

*First Biennial Report of the Progress of the Geological Survey, embracing observations on the geology, zoology and botany of the Lower Peninsula by A. Winchell, 1860. 339 pp. 1 geological map. Bound in green cloth.

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R. C. ALLEN, State Geologist, 1909–1919.

Note: The Publication of the Annual Report, as Such, Under a Single Cover, Was Discontinued With That for the Year 1908, and all Subsequent Reports are Issued in the Form of Publications.

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(a) Popular description of major geological structures of Lake Superior Basin, the stratigraphy, etc.: 1. The Keweenaw fault and other faults; 2. The general character and succession of the beds; 3. Sources of copper; 4. Agents of metamorphism; 5. Resultant minerals; 6. Shear zones and shoots; 7. Surface geology; 8. Distribution of float copper; (b) Nomenclature and chemical relations of the Keweenawan rocks; (c) Microscopic petrography—the minerals and textures; (d) The grain of igneous rocks; (e) Detailed stratigraphy as shown by the mines and outcrops; (f) Topographic-geologic map of Isle Royale.

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(h) GOLD IN MICHIGAN, by R. C. Allen: 1. Discovery in Michigan; 2. The Ropes and other mines; 3. Mining companies; 4. Placer gold.

(i) OIL AND GAS IN MICHIGAN, by R. A. Smith: 1. Exploration; 2. Anticlinals; 3. Oil fields and districts: Port Huron field; Southeastern district; Southwestern district; Western district; Central part of state: Northern part of Southern Peninsula; Northern Peninsula; 4. Tables of deep borings showing the several horizons, their depth, thickness, etc.; 5. Sketch map of anticlines.

(j) Directory of the mineral producers of Michigan.

(k) Miscellaneous statistical tables—pottery, mineral waters, clay, sandstone, lime, limestone, sand and gravel, sand-lime brick, brick and tile, summary of mineral products.

(l) Appendix—Production and value of mineral products of Michigan for 1911.

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(c) The Michigan Basin: 1. Major structure; 2. Minor structure; 3. The geological section and formations described.

(d) Geological factors controlling the occurrence of oil and gas: 1. The anticlinal theory; 2. Forms of oil and gas reservoirs; 3. Generalizations concerning the application of the anticlinal theory; 4. Rock, pressure and its causes; 5. Surface indications of oil and gas.

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(g) The Saginaw oil field: 1. The Saginaw Valley Development Company; 2. The Saginaw anticline; 3. The explorations; 4. The oil horizons; 5. Favorable area for exploration; 6. Character and composition of the oils.

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Publication 17, Geological Series 14. 1912–1914.

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(b) Powers and duties of the Board of Geological Survey.

(c) Functions of the Geological Survey: 1. Distribution of reports; 2. Correspondence and conferences; 3. Cooperation with the Board of State Tax Commissioners in the appraisal of mines and mineral lands; 4. Reports of the State Geologist to the Board of State Tax Commissioners; 5. Cooperation with the Michigan Securities Commission; 6. Cooperation with the Public Domain Commission.

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(e) Progress of the topographic survey of Michigan (with progress map); 1. Object of the survey; 2. Expenditures for cooperative topographic survey of Michigan; 3. Plan of cooperation in topographic mapping; 4. Report of topographic surveys July 1, 1912, to July 1, 1914; 5. Table of progress of the topographic survey in the United States.

(f) Progress of the Biological Survey of Michigan: 1. Plan of work; 2. Field work for 1913 and 1914; 3. Publications; 4. Recommendations.

(g) Recommendations to the Legislature relative: 1. To a proposed increase in appropriations for topographic mapping—need for and uses of topographic maps, appropriations for the Topographic Survey; 2. To the investigation of water powers, drainage, etc.; 3. To the need of a soil survey of Michigan—organization of a Soil Survey, recommendations; 4. To the regulation of the drilling and care of deep borings—harmful results of unregulated deep drilling, proposed regulations; 5. To the relation of the Geological and Biological Survey to the conservation of the birds and wild animals of the state; 6. To the proposed work of the Biological Survey—report of the Committee on Policy of the Biological Survey, plan of work, and nature of publications.

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Publication 18, Geological Series 15. 1915.

Part I. Contributions to the Pre-Cambrian Geology of Northern Michigan and Wisconsin, by R. C. Allen and L. P. Barrett, and Part II. The Geology of Limestone Mountain and Sherman Hill, in Houghton County, Michigan, by E. C. Case and W. I. Robinson, 190 pp., 12 pls., 16 Figs. (5 Maps).

Part I. Contributions to the Pre-Cambrian Geology of Northern Michigan and Wisconsin. 152 pp., 11 Figs. (5 Maps).

(a) Introduction and acknowledgments.

(b) A revision of the correlations of the Huronian group of Michigan and the Lake Superior region: 1. Correlation of the Animikie series as Middle Huronian; 2. Correlation of the Huronian group in the Gogebic and Marquette districts; 3. Correlation of the Vulcan (iron bearing) series with the Negaunee (iron bearing) series—Marquette and Crystal Falls districts; 4. Correlation of the Negaunee series with the Vulcan series of the Sturgeon trough, Felch Mountain district, Calumet trough, and Menominee range; 5. Correlation of the Ironwood (Animikie) of the Gogebic range with the Vulcan (Middle Huronian) series of the Crystal Falls-Iron River-Florence-Menominee district on the basis of similar relations to intrusive granite; 6. General remarks on the correlation of the Animikie series with the Middle Huronian.

(c) A revision of the sequence and structure of the Pre-Keweenaw formations of the eastern Gogebic iron range: 1. Introductory statement—summaries of the geology based on earlier work and of the writers' conclusions; 2. Archean system; 3. Algonkian system: Lower Huronian—Sunday quartzite and Bad River limestone; Middle (Animikie) Huronian—introductory statement, relation to other formations, geology of the Palms and Ironwood formations, Middle Huronian extrusives, basic extrusives, Presque Isle granite; Upper Huronian—The Copps formation; Keweenawan series—Relation to adjacent formations, Keweenaw(?) gabbro; 4. Structure of the Gogebic range east of Wakefield—Keweenawan series, Copps formation, and Middle Huronian series.

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. Retracement and Permanent Monumenting of the Michigan-Ohio Boundary, by R. C. Allen and C. E. Sherman, Commissioners, and S. S. Gannett, Engineer, 57 pp., 16 Pls. (13 maps), 1 Fig.

(a) Report of Commissioners: 1. Passage of laws by the legislatures of Michigan and Ohio for the "relocation, establishment and imperishable monumenting of the boundary between Michigan and Ohio"; 2. Organization and plan of work; 3. Statement of expenditures.

(b) Report of Engineer: 1. Preliminary reconnaissance; 2. Disappearance of original boundary marks; 3. Plan and execution of work; 4. Definition of boundary lines of Ohio and Michigan by laws of Congress; 5. Original surveys; 6. Resurveys; 7. Description of field operations; 8. Monuments; 9. Instruments; 10. Topography; 11. Astronomical observations.

(c) Appendix: 1. Character of monuments—granite posts; 2. Geographic positions; 3. Detailed descriptions of the location of the various posts.

(d) Basis of the Michigan-Ohio boundary dispute, by A. M. Schlesinger, 5 pp., 2 maps: 1. Early maps of the Western County; 2. Inaccuracies of the maps; 3. Misconceptions; 4. The dispute; 5. The compromise; 6. Bibliography of the Ohio-Michigan Boundary dispute.

(e) Appendix I. Lists of libraries and scientific and educational institutions to which reports of the Michigan Geological and Biological Survey are sent.

(f) Appendix II. Catalog and table of contents of the publications of the Michigan Geological and Biological Survey..... $0.70 1 lb.

**Publication 23, Geological Series 19. 1917.

Geological map of Michigan in colors, 34x42 inches, scale 1:750,000..... .50

Publication 24, Geological Series 20. 1917.

The Mineral Resources of Michigan for 1916 and prior years.

Part I. METALLIC MINERALS.

(a) Michigan Copper Industry in 1916, by W. E. Hopper, 50 pp., 7 Figs. (15 maps): 1. General Review—production and value of copper and silver, prices, dividends, wages, metallurgical development, etc.; 2. Construction; 3. Exploration and development; 4. Exploration, description, mineralization, and faulting; 5. Details of operations of mining companies; 6. List of active copper mining companies in 1916; 7. Summary table of results obtained by copper mining companies; 8. Summary table of financial statements of copper mining companies in 1916; 9. Summary table of results obtained by copper mining companies, 1912-16; 10. Geological maps of the Porcupine Mountains and the area between the White Pine mine and Lake Superior.

(b) Iron Ore Industry—statistical tables, 1 Fig.: 1. Summary tables of shipments of iron ore by districts—Marquette, Gwinn, Gogebic, Menominee, Crystal Falls, and Iron River districts; 2. Table of iron ore shipments by ranges; 3. By counties; 4. Number of men employed in Michigan iron mines; 5. List of active iron mines; 6. Iron ore reserves of Michigan; 7. Appraised value of Michigan iron mines; 8. Value of iron ore shipments in 1916; 9. Table showing costs, profits, losses, and assessments of the iron mines of Michigan, 1906–1916.

Part II. NON-METALLIC MINERALS.

(c) PORTLAND CEMENT INDUSTRY, by R. A. Smith, 40 pp., 2 Figs. (2 maps): 1. Classification of cements; 2. History and development of cement manufacture; 3. List of cement companies projected and built in Michigan up to 1917; 4. Raw materials; 5. Raw materials used in Michigan; 6. Marl—formation, occurrence, extent and composition of deposits in Michigan; 7. Table of analyses of Michigan marls; 8. Limestone—occurrence, distribution and character of the limestone formations in Michigan, with tables of analyses; 9. Shales and clays—occurrence, distribution and character of shales and clays in Michigan; 10. Use of gypsum in cement manufacture; 11. Fuels used in burning the clinker; 12. Growth of cement industry in the United States and in Michigan; 13. Statistical tables.

Miscellaneous non-metallic minerals.

(d) Salt industry: 1. Production and value in 1916; 2. History of industry in Michigan—growth in Wayne County; 3. Brine and salt deposits—occurrence and distribution; 4. Statistical tables.

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	Price.	Shipping Wt. or Postage.

(e) Gypsum Industry: 1. History and growth in Michigan; 2. Occurrence and distribution of gypsum; 3. Statistical tables.
(f) Coal: 1. History and growth of coal mining industry in Michigan; 2. Mining conditions; 3. Statistical tables.
(g) Limestone: 1. Growth of limestone industry in Michigan; 2. Distribution and character of the limestone deposits; 3. Statistical tables.
(h) Lime: 1. Lack of growth of industry in Michigan—causes; 2. Statistical table.
(i) Brick and tile products: 1. Occurrence, distribution and character of raw materials; 2. Production and value of output in 1916; 3. Statistical tables.
(j) Clay: 1. Character and distribution; 2. Developments; 3. Uses; 4. Statistical table.
(k) Pottery: 1. Growth of industry; 2. Products; 3. Sources of raw materials; 4. Statistical table.
(l) Sand-lime brick: 1. History and growth of industry in United States and Michigan; 2. Production and value in 1916; 3. Statistical table.
(m) Sandstone: 1. Decline of industry—causes; 2. Statistical table.
(n) Grindstones and scythestones: 1. Occurrence of grind or grit stones in Michigan; 2. Methods of quarrying and manufacturing.
(o) Sand and gravel: 1. Occurrence and distribution of sand and gravel deposits; 2. Developments; 3. Statistical table.
(p) Glass sand: 1. Occurrence and distribution of glass sand in Michigan; 2. Developments; 3. Statistical table.
(q) Natural gas: 1. Sources; 2. Developments; 3. Statistical table.
(r) Petroleum: 1. Occurrences; 2. Developments.
(s) Mineral and spring waters: 1. Decline of industry—causes; 2. Statistical table.
(t) Marble: 1. Occurrence and character; 2. Verde antique marble—occurrence, character and recent developments, etc., near Ishpeming.
(u) Shale: 1. Occurrence, distribution and character of shale in Michigan; 2. Developments.
(v) Slate: 1. Occurrence of black slates in Baraga County; 2. Attempted developments; 3. The Arvon slate quarries.
(w) Trap rock: 1. Occurrence and character of deposits in Michigan; 2. Developments; 3. Statistical table.
(x) Graphite: 1. Occurrence of graphitic slate near L'Anse, Baraga County; 2. Development; 3. Uses.
(y) Mineral paints: 1. Iron ores; 2. Manufactured metallic paints.
(z) Quartz: 1. Mining of vein quartz near Ishpeming; 2. Uses.
(aa) Feldspar: 1. Occurrence of feldspar deposits in Michigan; 2. Investigations and tests; 3. Analysis.
(bb) Celestite: 1. Occurrence in Monroe and Wayne counties; 2. Commercial possibilities.
(cc) Map showing location of mineral industries of Michigan.
(dd) Summary table of production and value of minerals and mineral products in Michigan, 1912-1916.

Part III. Deep borings in Michigan, 49 pp., 1 Fig.

(ee) Descriptions and records by counties: Allegan County—Saugatuck well; 2. Arenac County—Pine River well; 3. Clinton County—A. J. Moss and Verne Walker test borings for coal; 4. Delta County—Chicago and Northwestern Railway Co. at Escanaba and Pine Ridge test hole; 5. Eaton County—Eaton Rapids municipal well; 6. Gratiot County—Ithaca municipal well; 7. Houghton County—Calumet and Hecla Copper Mining Co., well at Lake Linden; 8. Huron County—Bad Axe Sugar Co. well; 9. Ingham County—Lansing municipal well; 10. Ionia County—Ionia municipal well; 11. Jackson County—Jackson well; 12. Kent County—Rockford municipal well; 13. Lenawee County—Continental Sugar Co. well at Blissfield ..... $0.80 2 lbs.

Publication 25, Geological Series 21. 1917.

Surface Geology and Agricultural Conditions of Michigan, by Frank Leverett, with a chapter on climate, by C. F. Schneider, 223 pp., 15 Pls., 25 Figs. (4 maps). (This report contains Publication 7, The Surface Geology of the Northern Peninsula and Publication 9, The Surface Geology of the Southern Peninsula revised to date.)

(a) Climatic conditions, by C. F. Schneider, with notes on the Northern Peninsula, by Frank Leverett: 1. Modifying effects of the Great Lakes; 2. Temperature; 3. Frosts; 4. Data on Northern Peninsula frosts; 5. Precipitation; 6. Drought; 7. Sunshine; 8. Winds; 9. Relative Humidity; 10. General climatic data.
(b) The Surface Geology of the Northern Peninsula: 1. Physiography; 2. Glacial features; 3. Lake history; 4. Notes on agricultural conditions—soil classes by counties and townships, and farm and crop data; 5. Water supply; 6. Small scale soil map of the Northern Peninsula.
(c) The Surface Geology of the Southern Peninsula: 1. Glacial features; 2. History of the glacial lakes; 3. Agricultural conditions—soil classes by counties and sections, and farm and crop data; 4. Small scale soil map of the Southern Peninsula ..... .60 2 lbs.

Shipping Wt. or Price. Postage.

**Publication 26, Biological Series 5, 1918.

Agaricaceae of Michigan, by C. H. Kauffman, with a chapter on Mushroom Poisoning by O. E. Fischer. In two volumes.

Vol. I, Text, 924 pp., 1 Pl., 4 Figs. Vol. II, Pls. I-CLXXII. This is a comprehensive and finely illustrated report on the Agaric Flora of Michigan. Eight hundred and eighty-four species are described, of which 177 are proven edible MUSHROOMS and 70 are poisonous or suspected ..... $4.00 6 lbs.

Publication 27, Geological Series 22.

Mineral Resources of Michigan for 1917 and prior years.

Part I. METALLIC MINERALS.

(a) Michigan Copper Industry in 1917. W. E. Hopper, 74 pages: 1. General Review—production and value of copper, prices, wages, dividends, income and excess profits taxes, structural and metallurgical development, etc.; 2. Exploration and development; 3. Construction; 4. Mining and milling; 5. Details of operations of mining companies; 6. List of active copper mining companies 1917; 7. Summary of results obtained by Michigan copper companies 1917; 8. Summary of financial statements of copper companies; 9. Summary results obtained by copper mining companies 1913–1917.

(b) Iron Ore Industry—statistical tables, 1 figure, pages 77-131: 1. Iron ore shipments from the Marquette range, Gwinn District, Gogebic Range, Menominee District, Crystal Falls District, Iron River District; 2. Summary of iron ore shipments from Michigan Ranges (Gross Tons); 3. Shipments of iron ore for Michigan Ranges by counties; 5. List of active iron mines in Michigan; 6. Iron ore reserves; 7. Appraised value of Michigan iron mines; 8. Value of iron ore shipments 1917; 9. Tables showing costs, profits, losses and assessments of iron mines of Michigan 1906-1917; 10. Analysis of Lake Superior Iron Ores and percentage of Bessemer and non-Bessemer grades, by W. L. Tinker; 11. Graphic record of shipments from iron mines.

Part II. NON-METALLIC MINERALS.

(c) Coal: 1. History and growth of coal mining industry in Michigan; 2. Statistical tables.

(d) Pyrites: 1. War demand for pyrites; 2. Investigation of Michigan coal brasses for pyrites; 3. Analyses and tests.

(e) Salt Industry: 1. Production and value in 1917; 2. History of salt industry in Michigan—revived by War; 3. Brine and salt deposits, occurrence and distribution; 4. Statistical tables.

(f) Bromine and calcium chloride: 1. Development of bromine and calcium chloride production in Michigan; 2. War needs and Government demand for.

(g) Potash: Production and value of, 1917.

(h) Clay: 1. Character and distribution; 2. Development; 3. Uses; 4. Statistical tables.

(i) Brick and Tile Products: 1. Occurrence, distribution and character of raw matuerials; 2. Production and value of output in 1917; 3. Statistical tables.

(j) Pottery: 1. Growth of Industry; 2. Products; 3. Statistical tables.

(k) Sandstone: 1. Decline of industry; 2. Statistical tables.

(l) Grindstones and scythestones: 1. Occurrence of grind or grit stones in Michigan.

(m) Sand and Gravel: 1. Occurrence, distribution and development of sand and gravel deposits in Michigan; 2. Statistical tables.

(n) Glass sand: 1. Occurrence and distribution of glass sand in Michigan; 2. Developments; 3. Analysis.

(o) Sand-lime brick: 1. History and growth of industry in Michigan; 2. Production and value; 3. Statistical tables.

(p) Limestone: 1. Growth of limestone industry in Michigan; 2. Distribution and character of limestone deposits; 3. Statistical tables.

(q) Lime: 1. Lack of growth in industry previous to the War,—causes; 2. War effect on industry; 3. Statistical tables.

(r) Cement: 1. Growth of industry; 2. History; 3. Statistical tables.

(s) Shale: Occurrence, distribution, character and development of shale in Michigan.

(t) Gypsum: 1. History and growth of industry in Michigan; 2.

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Occurrence and distribution; 3. Statistical tables.
(u) Mineral Waters: 1. Decline of industry; 2. Statistical tables.
(v) Natural gas: 1. Sources; 2. Developments; 3. Statistical tables.
(w) Petroleum: 1. Occurrence; 2. Developments.
(x) Marble: 1. Occurrence and character; 2. Verde antique marble—occurrence, development, comparison with Grecian marble.
(y) Graphite: 1. Occurrence of graphite slate in Baraga County; 2. Use.
(z) Mineral Paints: 1. Iron ores; 2. Manufacture from graphitic slates.
(aa) Celestite: Occurrence of, in Monroe and Wayne Counties.
(bb) Feldspar: Occurrence, investigation of feldspar deposits; 2. Analysis.
(cc) Quartz: Mining of quartz near Ishpeming.
(dd) Trap Rock: 1. Occurrence and character of deposits; 2. Uses; 3. Statistical tables.
(ee) Slate: 1. Slate deposits in Northern Peninsula; 2. Attempted developments.
(ff) Map showing location of mineral industries in Michigan.
(gg) Summary tables of production and value of mineral products in Michigan 1913–1917.
Appendix. Directory producers of non-metallic minerals in Michigan in 1917 ..... $0.80 2 lbs.

Publication 28, Geological Series 23, 1918.

Drainage in Michigan, by Dalton G. Miller and Perry T. Simons. 126 pp., 5 Figs., 13 Pls. (2 maps).

(a) Condition affecting Drainage: 1. Rainfall and climate; 2. Topography; 3. Soils.
(b) Wet Lands of Michigan: 1. Reclaimable wet lands of the Southern Peninsula; 2. Swamp and wet lands of the Northern Peninsula; 3. Summary of wet lands of Michigan.
(c) Drainage in Michigan: 1. Earlier drainage; 2. Development of County Drain System, expenditures on, and cost analysis of County Drains; 3. Suggestions on designs of drains, run-off from watersheds, size znd shape of open ditches, grade for open ditches, width of berm; 4. Construction methods; outlets, uniform method of staking ditches, cubic yard basis for letting contracts; 5. Tile drains for county work; 6. Inspection; 7. Maintenance.
(d) The Michigan Drain Law: 1. Purpose of the law; 2. Procedure of establishing a drain; 3. Drains which affect more than one county; 4. Deficiencies in present procedure; 5. Necessity for bonding provision.
(e) Necessity for creation of State Department to handle water resources and drainage matters.
(f) Abstracts of Drainage Laws of Georgia, Iowa, Missouri, Ohio and Wisconsin: 1. Georgia; 2. Iowa; 3. Missouri; 4. Ohio; 5. Wisconsin.. .60 2 lbs.

Publication 29, Geological Series 24,

Mineral Resources of Michigan for 1918 and prior years.

Part I. Metallic Minerals.
(a) Michigan Copper Industry in 1918. L. P. Barrett, 45 pp. 1. General Review—production, sales, value, costs, dividends; 2. Details of operations of mining companies; 3. Table of average cost , receipts, etc., for 1918; 4. List of active copper mining companies 1918; 5. Summary of financial statements of copper companies; 6. Summary results obtained by copper mining companies, 1914–1918.
(b) Iron Ore Industry. O. R. Hamilton. Statistical tables, 4 Figs., 55 pp.: 1. General Review—shipments, mining costs, royalties, market trend for Bessemer pig iron; 2. Iron ore shipments from the Marquette range, Gwinn district, Gogebic range, Menominee district, Crystal Falls district, Iron River district; 3. Summary of iron ore shipments by ranges (gross tons); 4. Shipments of iron ore from Michigan ranges by counties; 5. Number of men employed in Michigan iron mines; 6. List of active iron mines in Michigan; 7. Iron ore reserves of Michigan; 8. Appraised value of Michigan iron mines; 9. Value Michigan iron ore shipments, 1919; 10. Tables showing costs, profits, losses, and assessments of Michigan iron mines, 1906–1918; 11. Graphic record of cost of delivery of Michigan iron ore at the Lower Lake ports; 12. Graphic record of shipments of Michigan iron ore.
Part II. Non-Metallic Minerals.
Non-metallic Industry in Michigan in 1918. H. M. Martin. 1 Fig., 67 pp.: 1. General Review—value, rank, effect of building operations on brick and tile industry, effect of war upon non-metallic industries.
(c) Salt Industry: Production and value in 1918; 2. History of salt industry in Michigan—effect of war upon; 3. Brine and salt deposits—occurrence and distribution; 4. Statistical tables.
(d) Bromine and Calcium Chloride: 1. Development of bromine in Michigan; 2. War uses and Government demand for; 3. Calcium chloride,

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production value and uses.
(e) Cement: 1. Growth of industry; 2. History; 3. Statistical tables.
(f) Potash: Production and value of 1918. By-product of cement industry.
(g) Gypsum: 1. History and growth of industry in Michigan; 2. Statistical tables.
(h) Brick and tile products: 1. Occurrence, distribution and character of raw materials; 2. Production and value of output in 1918; 3. Effect of war upon industry; 4. Statistical tables.
(i) Shale: Occurrence, distribution, character, and development of shale in Michigan.
(j) Clay: 1. Character, distribution, development uses of clay in Michigan; 2. Statistical tables.
(k) Pottery: 1. Growth of industry, products; 2. Statistical tables.
(l) Coal: History and growth of coal mining in Michigan; 2. Statistical tables.
(m) Pyrites: 1. War demand for; 2. Investigation of Michigan coal brasses for pyrites; 3. Analyses and tests.
(n) Limestone: 1. Growth of limestone industry in Michigan; 2. Distribution and character of limestone deposits; 3. Statistical tables.
(o) Lime: 1. Lack of growth of industry before the war—causes; 2. War stimulation of industry; 3. Statistical tables.
(p) Sand-lime brick: History and growth of the industry in Michigan; 2. Production and value; 3. Statistical tables.
(q) Sand and gravel: 1. Occurrence, distribution and development of sand and gravel deposits in Michigan; 2. Statistical tables.
(r) Sandstone: 1. Decline of industry; 2. Statistical tables.
(s) Grindstones and Scythestones: Occurrence of grind or grit stones in Michigan.
(t) Glass sand: 1. Occurrence and distribution of glass sand in Michigan; 2. Developments; 3. Analyses; 4. Government demand for.
(u) Mineral Waters: 1. Decline of industry; 2. Statistical tables.
(v) Natural Gas: 1. Sources, development; 2. Statistical tables.
(w) Petroleum: Occurrence, developments.
(x) Marble: 1. Occurrence and character; 2. Verde antique marble—occurrence, development, comparison with Grecian marble.
(y) Graphite: Occurrence and use of graphitic slate in Baraga county.
(z) Mineral paints: Production of mineral paints from iron ores of Iron County, and from graphitic slate of Baraga County.
(aa) Celestite: Occurrence of in Wayne and Monroe Counties.
(bb) Feldspar: 1. Occurrence, investigation of deposits; 2. Analysis.
(cc) Quartz: Mining of quartz near Ishpeming.
(dd) Trap rock: 1. Occurrence and character of deposits; 2. Uses; 3. Statistical tables.
(ee) Slate: 1. Slate deposits in Northern Peninsula; 2. Attempted development.
(ff) Map showing location of mineral industries.
(gg) Summary tables of production and value of mineral products in Michigan, 1914–1918.

Appendix. Directory producers of non-metallic minerals in Michigan in 1918 ..... $0.75 2 lbs.

Publication 30, Geological Series 25.

The Inland Lakes of Michigan, by Irving D. Scott.

In preparation, to be issued about April, 1921.

LIST OF AVAILABLE MAPS

STATE MAPS

	Price.
**Publication 23, Geological Series 19. 1916.	
Geological map of Michigan. In colors, 36 in. x 44 in., scale 1:750,000...	$0.50
*Map of the Surface Geology or soils of the Northern Peninsula of Michigan. In colors, 32 in. x 60 in., scale 1:380,000, or 6 miles to the inch. This map is the same as that in Pub. 9	.50
Map of the Surface Geology or soils of Northern Peninsula of Michigan. In colors, 13 in. x 24 in., scale 1:1,000,000, or about 16 miles to the inch. This map is the same as that in Publication 25. Map sent free upon request. Extra copies 10 cents each.	
Map of the Surface Geology or soils of the Southern Peninsula of Michigan. In colors, 18 in. x 24 in., scale 1:1,000,000, or about 16 miles to the inch. This map is the same as that in Publications 9 and 25. Map sent free upon request.	
Sketch map of the Surface Geology or soils of the region about the northern shores of Lakes Huron and Michigan. In colors, 8½ in. x 22 in., scale nearly 10 miles to the inch. This map is the same as that in Russell's report in the Annual Report for 1904. Map sent free upon request.	
*Map of the original vegetation of the Northern Peninsula. In colors, about 21 in. x 25 in., scale about 12 miles to the inch. This map is the same as that in the Report on Peat, Annual Report for 1906.	

BASE MAPS

Black and blue base map of Michigan, 36 x 44 in., scale 1:750,000, heavy paper	.35
Black base map of Michigan, prepared by the U. S. Geological Survey. In two parts, scale 1:500,000, light paper	.45
Part I. Map of the Northern Peninsula, including the northern part of the Southern Peninsula, 34 in. x 52 in.	.20
Part II. Map of the Southern Peninsula, excepting the northern portion, 34 in. x 52 in.	.25
Black base map of the Northern Peninsula, 13 in. x 24 in., scale 1:1,000,000, heavy paper	.10
Black base map of the Southern Peninsula, 18 in. x 24 in., scale 1:1,000,000, heavy paper	.10

*Out of print.
**For sale only.

COUNTY MAPS

ARENAC COUNTY.

Map showing Palaeozoic formations of Arenac County, topography of surface in contours, culture, etc. In colors, 20 x 34 in., scale 1:62,500, or about one inch to one mile. Map sent free upon request.

BARAGA COUNTY**

	Price.
No. 164. Map of Baraga County, showing topography, geology, culture, and municipal boundaries. *Blue print*, 36 in. x 41 in., scale 1 in.:1 mi.	$0.40
No. 164½. Map of vicinity of Huron Bay, Baraga County, showing geology, rock outcrops, topography, and culture. *Blue print*, 27 in. x 29 in., scale 2 in.:1 mi	.25
No. 14A. Township plats of Baraga County. *Blue print*, 14 in. x 14 in., T. 48 N., R. 31 W., scale 2 in.:1 mi. Vicinity of Michigamme. Geology, swamps, lakes, rivers, and culture	.20
No. 14B. T 48 N., R. 32 W., scale 2 in.:1 mi. Vicinity of Nestoria. Swamps, rivers, lakes, and culture	.20
No. 14C. T. 48 N., R. 33 W., scale 2 in.:1 mi. Geology, swamps, lakes, rivers, rock outcrop, and culture	.20
No. 14D. T. 48 N., R. 34 W., scale 2 in.:1 mi. Geology, swamps, lakes, rivers, rock outcrops, and culture	.20
No. 14E. T. 48 N., R. 35 W. (W. ½ in Houghton Co.), scale 2 in.:1 mi. Vicinity of Sidnaw. Swamps, rivers, lakes, rock outcrops, and culture	.20
No. 14F. T. 49, R. 33 W., scale 2 in.:1 mi. Vicinity of Detroit Graphite Co. and Northern Graphite Co. mines. Topography, geology, rock outcrops, and culture	.20
No. 14G. T. 50 N., R. 30 W., scale 2 in.:1 mi. Topography, geology, rock outcrops, and culture	.20
No. 14H. T. 50 N., R. 31 W., scale 2 in.:1 mi. (also 4 in.:1 mi., $.25). Geology, topography, rock outcrops, and culture	.20
No. 14I. T. 50 N., R. 32 W., scale 2 in.:1 mi. Geology, topography, rock outcrops, and culture	.20
No. 391. T. 50 N., R. 33 W. Scale 2 in.:1 mi	.20
No. 14K. T. 51 and 52 N., R. 30 W. Scale 2 in.:1 mi. Topography, geology, rock outcrops, and culture	.20

BAY COUNTY

Topographic map of Bay County; 14 in. x 20 in., scale about 1 in:2 mi. This map is the same as that in the Bay County Report, Annual Report for 1905. Map sent free upon request.

Topographic map of Bay County, showing surface geology. In colors, same base as above. Map sent free upon request.

Topographic map of Bay County, showing artesian well areas. In colors; same base as above. Map sent free upon request.

DELTA COUNTY**

No. 122. Map of the region west of Escanaba, showing magnetic belts. *Blue print*, 18 in. x 34 in., scale 2 in.:1 mi	.25

DICKINSON COUNTY**

No. 162. Map of Dickinson County, showing topography, geology, and culture. *Blue print*, 30 x 41 in., scale 1 in.:1 mi	.30

GOGEBIC COUNTY**

No. 169–170. Map of Gogebic County, in two parts, showing geology, topography, culture, etc. *Blue print*, scale 1 in.:1 mi	.75
No. 169. I. West End; 38 in. x 40 in	.40
No. 170. II. East End; 32 in. x 40 in	.35
No. 172A. Map of Gogebic Iron Range from West Branch of Montreal River, Wisconsin, east to Lake Gogebic, Michigan, showing geology, topography, culture, etc. *Blue print*, 15 in. x 69 in., scale 2 in.:1 mi	.50
No. 173A. Map of Gogebic Iron Range (T. 47 N., R. 42-44 W., excepting top tier of sections), showing geology, topography, outcrops, etc. *Blue print*, 32 in. x 78 in., scale 4 in.:1 mi	.65
Township plats in Gogebic County. *Blue prints*, 28 in. x 28 in., scale 4 in.:1 mi	.25 each
No. 26. T. 43 N., R. 37–38 W. (west half in Iron County), 14 in. x 26 in. scale 2 in.:1 mi. Rivers, lakes, etc.	
No. 34. T. 43 N., R. 38 W. (Fractional). Streams, lakes, etc.	
No. 35. T. 43 N., R. 39 W. (Fractional). Streams, lakes and swamps.	
No. 36. T. 44 N., R. 38 W. Magnetic survey, culture, etc., in south-central part.	

*Out of print.
**For sale only.

No. 37. T. 44 N., R. 39 W. Streams, lakes and swamps.
No. 38. T. 44 N., R. 40 W. (Fractional). Magnetic and geologic survey, culture, etc.
No. 39. T. 44 N., R. 41 W. (Fractional). Magnetic and geologic survey, rock outcrops, topography (sketched), culture, etc.
No. 40. T. 44 N., R. 42 W. (Fractional). Magnetic and geologic survey, culture, etc., of the northwest corner.
No. 41. T. 44 N., R. 43 W. (Fractional). Streams, lakes, etc.
No. 42. T. 45 N., R. 38 W. Magnetic and geologic survey, culture, etc.
No. 43. T. 45 N., R. 39 W. Magnetic and geologic survey, topography (sketched), culture, etc.
No. 44. T. 45 N., R. 40 W. Magnetic and geologic survey, culture, etc.
No. 45. T. 45 N., R. 41 W. Magnetic and geologic survey, rock outcrops, culture, etc.
No. 46. T. 45 N., R. 42 W. Magnetic and geologic survey, culture, etc.
No. 47. T. 45 N., R. 43 W. (Fractional). Magnetic and geologic survey, culture, etc., of the southeastern half of the township.
No. 48. T. 45 N., R. 44 W. (Fractional). Magnetic and geologic survey, culture, etc.
No. 49. T. 45 N., R. 45 W. (Fractional). Magnetic and geologic survey, culture, etc.
No. 50. T. 45 N., R. 46 W. (Fractional). Streams, lakes, etc.
No. 51. T. 46 N., R. 39 W. Magnetic and geologic survey, rock outcrops, topography (sketched), culture, etc.
No. 52. T. 46 N., R. 40 W. Magnetic and geologic survey, rock outcrops, topography (sketched), culture, etc.
No. 53. T. 46 N., R. 41 W. Magnetic and geologic survey, rock outcrops, topography (sketched), culture, etc.
No. 54. T. 46 N., R. 42 W. Magnetic and geologic survey, rock outcrops, culture, etc.
No. 55. T. 46 N., R. 43 W. Magnetic and geologic survey, rock outcrops, culture, etc.
No. 56. T. 46 N., R. 44 W. Magnetic and geologic survey, rock outcrops, culture, etc., of the south half of township.
No. 57. T. 46 N., R. 45 W. Magnetic and geologic survey, rock outcrops, culture, etc., of the southeast corner of the township.
No. 58. T. 46 N., R. 46 W. Streams, lakes, etc.
No. 59. T. 46 N., R. 47 W. Streams, lakes, etc.
No. 60. T. 47 N., R. 39 W. Streams, lakes, etc.
No. 61. T. 47 N., R. 40 W. Streams, lakes, etc.
No. 62. T. 47 N., R. 41 W. Streams, lakes, etc.
No. 63. T. 47 N., R. 42 W. Streams, lakes, etc.
No. 64. T. 47 N., R. 44 W. Streams, lakes, etc.
No. 65. T. 47 N., R. 45 W. Streams, lakes, etc.

HOUGHTON COUNTY**

Price.

Nos. 181–182. Map of Houghton County (in two parts), showing geology, topography, culture, etc. *Blue print*, scale 1 in.:1 mi..... $0.60
No. 181. I. Northern part Ts. 51-56 N., Rs. 31-36 W.; 39 in. x 41 in. .40
No. 182. II. Southern part, Ts. 47-50 N., Rs. 35-37 W.; 20 in. x 30 in. .25
Township plats of Houghton County. *Blue prints.*
No. 65A. T. 47 N., R. 36 W., 14 in. x 14 in., scale 2 in.:1 mi. Rivers, swamps, lakes, roads, culture, etc..... .20
No. 65B. T. 47 N., R. 37 W., 14 in. x 14 in., scale 2 in.:1 mi. Geology, rock outcrops, culture, etc..... .20

HURON COUNTY

Map of bed rock geology and topography of Huron County. In colors, 23 in. x 28 in., scale ½ inch to the mile. This map is the same as that in the Geological Report on Huron County, Part II, Vol. VII. Map sent free on request.

IRON COUNTY**

No. 165. Map of Iron County, showing geology, topography, culture and municipal boundaries. *Blue print*, 38 in. x 44 in., scale 1 in.:1 mi.. .40
No. 168. Map of Iron River District, showing surface and rock contours. *Blue print*, 38 in. x 38 in., scale 4 in.:1 mi..... .40
Township plats of Iron County. *Blue prints.*
No. 15. T. 42 N., R. 34 W. (Fractional), 26 in. x 30 in., scale 4 in.:1 mi. Magnetic survey of northwestern part..... .25
No. 16. T. 42 N., R. 35 W. (Fractional), 26 in. x 30 in., scale 4 in.:1 mi. .25
No. 16½. T. 42 N., R. 35 W. Scale 2 in.:1 mi. Magnetic survey, geology and rock outcrops in an east-west belt through the center of Twp.. .25
No. 17. T. 42 N., R. 36 W. (Fractional), 26 in. x 30 in., scale 4 in.:1 mi. Magnetic survey, culture, etc..... .25
No. 18. T. 42 N., R. 36 W. (Fractional), 11 in. x 13 in., scale 2 in.:1 mi. Magnetic survey, geology, rock outcrops, topography (sketched), culture, etc..... .20

**Maps for sale only.

Price.

No. 19. T. 42 N., 37 W. (Fractional), 15 in. x 26 in., scale 4 in.:1 mi. Magnetic survey, culture, etc. $0.25

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KEWEENAW COUNTY

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*Geologic map of the Allouez Gap Area, showing topography in contours and the location of some of the principal beds of the Keweenaw series. This map is the same as that in Vol. VI, Pt. II. 12 in. x 12 in.

Geologic-Topographic map of Keweenaw Point in contours. 22 in. x 34 in., scale 1 in.:1 mi. This map is the same as that in Vol. VI, Pt. II. Map sent free upon request.

MARQUETTE COUNTY**

Nos. 150-2. Map of Marquette County, in three parts. *Blue print*, scale 1 in.:1 mi. .90

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No. 123. Map of the magnetic belts in the vicinty of Radford. *Blue print*, 11 in. x 17 in., scale 2 in.:1 mi. .20

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**For sale only.

*MONROE COUNTY

Price.

Map of surface geology or soils, and topography of Monroe County. In color. 16 in. x 18 in., scale ½ mile to the inch. This map is the same as that in the Geological Report on Monroe County, Part I, Vol. VII.

Map of bed rock geology and topography of Monroe County. In colors; same base as above. This map is the same as that in the Geological Report on Monroe County, Part I, Vol. VII.

ONTONAGON COUNTY**

Nos. 178-180. Map of Ontonagon County (in three parts), showing geology, topography, and culture. *Blue print*, scale 1 in.:1 mi..... $0.95
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Township plats of Ontonagon County. *Blue prints.*

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Topographic map of the Ann Arbor Quadrangle, showing contours of elevation, timber areas, culture, etc. Scale 1:62,500, or about 1 in. to one mile, 27 in. x 37 in. Map sent free upon request.

WAYNE COUNTY.

Map of Wayne County, showing surface geology or soils, topography and depth of drift in contours, culture, etc. In colors. 33 in. x 41 in., scale 1:62,500, or about 1 mile to the inch. This map is the same as that in Publication 12. Map sent free upon request.

Map of Wayne County, showing hard rock geology, artesian well conditions, topograhy of the surface and hard rocks in contours, culture, etc. In colors, 33 x 41 inches, scale 1:62,500, or about 1 mile to the inch. This map is the same as that in Publication 12. Map sent free upon request.

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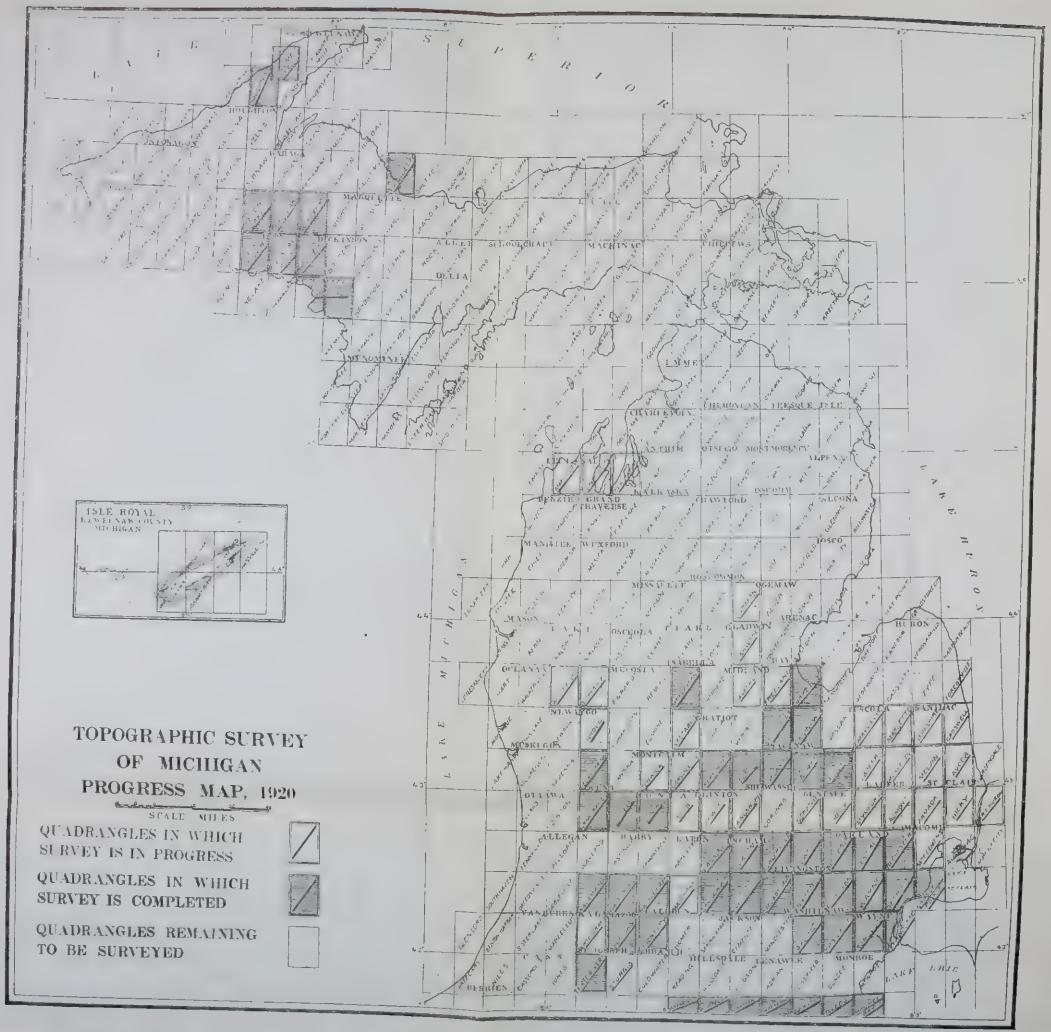
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MICHIGAN
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OF MICHIGAN
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QUADRANGLES IN WHICH SURVEY IS COMPLETED
QUADRANGLES REMAINING TO BE SURVEYED
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LAKE MICHIGAN
LAKE HURON
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CALHOUN
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WASHTENAW
WAYNE
ST. JOSEPH
BRANCH
HILLSDALE
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MONROE
LAKE ERIE

SOIL MAPS

Price.

The Survey has on file unpublished manuscript maps made by Mr. Frank Leverett, of the United States Geological Survey, showing the surface geology and the agricultural conditions of the Northern Peninsula and of the following counties and quadrangles in the Southern Peninsula:

Counties: Alcona, Alpena, Antrim, ~~Arenac~~, Benzie, Charlevoix, Cheboygan, Clare, Crawford, Emmet, Grand Traverse, Iosco, Isabella, Kalkaska, Lake, Leelanau, Manistee, Mason, Mecosta, Missaukee, Montmorency, Newaygo, Oceana, Ogemaw, Osceola, Oscoda, Otsego, Presque Isle, Roscommon, Wexford. Scale ¾th in.:1 mi.

Quadrangles: Battle Creek, Bay City, Camp Custer, Cedar Springs, Chesaning, Elsie, Fowlerville, Galesburg, Grand Rapids, Howell, Ionia, Kalamazoo, Lansing, Leonidas, Mason, Milford, Mount Pleasant, Perrinton, Pontiac, Rochester, St. Charles, Saginaw, Three Rivers, Union City. Scale 1:62,500. Lowell

The Survey is prepared to have copies of these maps made upon application. The maps are colored by hand and are sold for ~~$1.25~~ 1.50 for the county maps, and $1.50 for the quadrangles.

The United States Bureau of Soils has issued the following soil maps of Michigan:

Allegan, Berrien*, Cass, Calhoun, Wexford Counties; the Alma area in Gratiot County, Oxford area in Oakland County, Owosso area in Shiawassee County, Pontiac area in Oakland County, Saginaw area in parts of Saginaw, Bay, Tuscola, and Huron Counties; and the Munising area in the Northern Peninsula. Scale 1 in.:1 mi.

TOPOGRAPHIC MAPS

The topographic survey of Michigan is being made in cooperation with the U. S. Geological Survey. Each topographic map covers a quadrangular area of about 200 square miles. The maps are on a scale of 1:62,500, or about one mile to the inch. They show the elevation and configuration of the surface by brown lines (contour lines); the roads, cities, villages, schools, etc., by black symbols; and the rivers, swamps, lakes, and drains by blue color. The following quadrangles have been surveyed and the maps may be obtained either from this Survey or from the U. S. Geological Survey, Washington, D. C.

Northern Peninsula: Calumet Special, Crystal Falls, Houghton, Iron River, Marquette, Menominee Special, Ned Lake, Perch Lake, Passage Island, Sagola, Witbeck ..... price, each, $0.10

Southern Peninsula: Alvordton,** Ann Arbor,† Battle Creek, Bay City, Burt,* Camp Custer,†† Cedar Springs, Chesaning, Detroit, Dexter, Elsie, Flint,* Fowlerville, Fremont,** Galesburg, Grand Rapids, Grosse Pointe, Howell, Ionia, Kalamazoo, Lansing, Leonidas, Lowell, Mason, Maumee Bay,** Milford, Montpelier,** Mt. Pleasant, Perrington, Pontiac, Rives Junction,* Rochester, Romulus, St. Charles, Saginaw, Saline, South Lyon, Springport,* Stockbridge,* Swanton,** Three Rivers, Toledo,** Union City, Wauseon,** Wayne, Wyandotte, Ypsilanti.

Price each ..... .10

NOTE: The Dexter, Saline, South Lyon and Ypsilanti sheets, together with maps of the areal geology of the quadrangles, are also published in U. S. G. S. Folio 155, and the Detroit, Grosse Pointe, Romulus, and Wyandotte quadrangles and maps of their areal geology are published in U. S. G. S. Folio No. 205.

*In press.

**Ohio boundary maps.

†Contours in black, forest areas in green. See Folio 155.

††Map formed by combining the Battle Creek and Galesburg quadrangles. A text, prepared by Frank Leverett, printed on the back of the map, gives an account of the geography of the region in the vicinity of Camp Custer with an explanation of the origin of the surface features.

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PUBLICATIONS OF THE U. S. GEOLOGICAL SURVEY RELATING TO MICHIGAN *which can be obtained only from the United States Geological Survey, or from the Superintendent of Documents, Washington, D. C.*

Folios

Geologic descriptions of nine Michigan quadrangles have been published in folio form by the U. S. Geological Survey.

Price.

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Annual Reports

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**Seventh Annual Report. 1885-86, pp. 365-454. On the classification of early Cambrian and pre-Cambrian formations, by R. D. Irving.

**Fifteenth Annual Report. 1893-94, pp. 477-650. Preliminary report on the Marquette iron-bearing district of Michigan, by C. R. Van Hise and W. S. Bayley, with a chapter on the Republic Trough, by H. L. Smyth.

Sixteenth Annual Report. 1895-96, Part I, pp. 571-874. *Principles of North American pre-Cambrian Geology, by C. R. Van Hise, with an appendix on the flow and fracture of rocks as related to structure.

Eighteenth Annual Report. 1896-97, Part I, pp. 595-647. **Recent Earth Movements in the Great Lakes Region, by C. K. Gilbert.

Nineteenth Annual Report. **Part III, pp. 1-151. The Crystal Falls iron-bearing district of Michigan, by J. M. Clements and H. L. Smyth, with a chapter on the Sturgeon River Tongue by W. S. Bayley, and an introduction by C. R. Van Hise.

Twenty-first Annual Report. 1899-1900. **Part III, pp. 305-434. The iron-ore deposits of the Lake Superior region, by C. R. Van Hise.

Twenty-second Annual Report. 1900-01. **Part III, pp. 307-331. The Northern Interior coal field, by A. C. Lane, pp. 629-685; The Portland Cement Industry in Michigan, by I. C. Russell.

**Monographs

5. The Copper-bearing Rocks of Lake Superior, by R. D. Irving. 1883. xvi, 464 pp., 29 pls., and maps..... 1.85

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36. The Crystal Falls iron-bearing district of Michigan, by J. M. Clements and H. L. Smyth, with a chapter on the Sturgeon River Tongue, by W. S. Bayley, and an introduction by C. R. Van Hise. 1899, xxxvi, 512 pp., 53 pls..... 2.00

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Professional Papers

**11. The Clays of the United States East of the Mississippi River, by H. Ries. 1903. pp. 298, Pls. 9.

*Out of print.

**Publication may be purchased from the Superintendent of Documents, Washington, D. C.

Bulletins

*62. The greenstone schist areas of the Menominee and Marquette regions of Michigan, a contribution to the subject of dynamic metamorphism in eruptive rocks, by G. H. Williams, with an introduction by R. D. Irving. 1890. 241 pp., 16 Pls.

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Michigan-Wisconsin: Black River, Beechwood, Commonwealth, Crystal Falls, Escanaba, Greenland, Hardwood, Hermansville, Houghton, Iron River, Kenton, Menominee Special, Norway, Paynesville, Rubicon, Sagola, Sidnaw, State Line, Watersmeet and Winona quadrangles.

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*585. Useful minerals in the United States, compiled by Samuel Sanford and R. W. Stone. 1914. pp. 97 to 100. (See Bulletin 624.)

624. Useful minerals of the United States, compiled by F. C. Shrader, R. W. Stone, Samuel Sanford (a revision of Bul. 585), 1916. pp. 163-169.

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669. Salt resources of the United States. W. C. Phalen. 1919. pp. 44-67.

697. Gypsum deposits of the United States. R. W. Stone and others. 1920. pp. 122-128.

Water Supply Papers

* 30. Water Resources of the Lower Peninsula of Michigan, by A. C. Lane. 1899. 97 pp., 7 Pls.

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49. Operations at river stations, 1900. Part III. pp. 229-260.

65. Operations at river stations, 1901, East of Mississippi river. 1902. pp. 315-318.

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83. Report of progress of stream measurements for calendar year 1902, by F. H. Newell. pp. 241-297.

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*340. Stream-gaging stations and publications relating to water resources, 1885–1913, compiled by B. D. Wood. 1916. (d) Part IV, St. Lawrence River Basin, pp. 43-52—xx.

354. Surface water supply of the United States, 1913, Part IV, St. Lawrence River Basin; N. C. Grover, chief hydraulic engineer; W. G. Hoyt, A. H. Horton and C. C. Covert, district engineers. 1915. 136 pp., 2 Pls.

384. Surface water supply of the United States, 1914, Part IV, St. Lawrence River Basin; prepared under the direction of N. C. Grover, chief hydraulic engineer, by W. G. Hoyt, A. H. Horton, C. C. Covert and C. H. Pierce. 1916. 128—xxix pp., 2 Pls.

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Mineral Resources of the United States for 1882-1917, with special reference to:

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Pt. II-*b. Coal: Brief descriptions of the coal fields in each of the producing states, illustrated by 14 maps showing the coal areas, by E. W. Parker.

1911, Pt. I-b. Iron ore reserves of Michigan, with map by C. K. Leith.

1915, Pt. I-e. Iron Ore: Beneficiation of Lake Superior iron ores, by Edmund Newton and H. H. Bradt.

Pt. I-1. Copper, by B. S. Butler: Map of the United States showing location of copper producing districts and reduction plants in 1915.

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